THE CARE OF THE TEETH

SAMUEL A. HOPKINS, M.D., D.D.S.

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BY

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PROFESSOR OF THEORY AND PRACTICE OF DENTISTRY
IN TUFTS COLLEGE DENTAL SCHOOL

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TO

MY MOTHER

WHO HAS INSPIRED EVERY NOBLE THOUGHT
AND WORTHY ACTION OF MY LIFE
THIS BOOK IS LOVINGLY DEDICATED

INTRODUCTION

OBSERVATIONS made during an active practise of over twenty years have convinced the writer of the truth of two propositions: first, that a large proportion of dental operations are preventable, and, second, that a large proportion of the world's inhabitants are ignorant of how to prevent them. To mark out a simple course of prevention that may be useful to the dentist, to the physician, and to the individual is the object of this work. The Utopian age when dental operations shall become unnecessary has not been reached, but it is safe to say that in all ages and at all times the best interests of the practitioner will be found to be identical with the best interests of his patient.

In every profession we find that the highest aim of the noblest men is to prevent trouble. The highest type of lawyer is he that best succeeds in preventing litigation. The best physician is that one who has labored hardest to prevent the disease which he is called upon to treat, and the most useful dentist is not that one who is content to repair

damage and restore loss, but that one who labors unceasingly to prevent such disastrous conditions from occurring.

Because I believe that the decay of teeth may in a great measure be prevented I have written this little book. I trust that the suggestions it contains will be found practical and of easy application. I trust that they will commend themselves to the mothers of growing children, to physicians who have an opportunity to influence the lives of these little ones, and to the dentists in whose hands the responsibility for the care of the teeth finally reposes.

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CHAPTER I

HISTORY OF DENTISTRY—USES OF TEETH

Almost from the beginning of time there has been a certain interest shown in the eruption and development of the teeth. We find allusions to the teeth and to some rude forms of dentistry in the earliest works on medicine and hygiene to which we have recourse, and it is safe to say that in the domestic life of the present day the interest manifested in the cutting of the first tiny incisor is second only to the interest shown in the birth of the child itself.

If the attempt were made to trace in outline the history of dentistry, we should be obliged to go back to the earliest Chinese works on medicine. There we should find references which would lead us to suppose that eighteen hundred years before Christ the art of medicine had made considerable progress in China, and that a certain place more or less prominent had been assigned to the care of the teeth. The earliest Hindu work on medicine, written about 1500 B. C., contains allusions to the

teeth and gives definite rules for the cleansing of the mouth. Some of the Hindu laws of health were considered so important that for their better enforcement they were embodied in sacred works, and among them was at least one rule which provided for the cleansing of the mouth after eating. The ancient Hindu had, it seems, grasped a fact the importance of which is now beginning to dawn upon modern civilization, namely, that the very portal of the human body, that gateway through which life's sustenance passes, and through which also the germs of disease may enter the system, should be kept pure and clean in order that the health of the individual may not suffer.

That the Romans had some knowledge of dentistry, and attached considerable importance to the teeth, is attested by certain references found in the laws of the twelve tables. Some of these laws were probably directed toward the suppression of ostentation in burial. They provide that "the dead are not to be buried in more than three robes, nor in more than three fillets of purple, nor shall the funeral be attended by more than ten flute-players." It is also provided that "gold must not be buried with the dead, but if the teeth are fastened with gold, this may be either buried or burned."

J. Grasset St. Sauveur, in L'Antique Rome, speaking of the Romans, says: "In order to keep their teeth clean and white they used a great deal of a certain liquid of curious composition. They

knew the use of small brushes and toothpicks of gold, of silver, and of quill." Martial says: "The Romans took great care of their teeth by washing and rubbing them. When they lost them they procured artificial teeth of ivory. If loose, they bound them with gold." Jacob von Faulke, in Greece and Rome, their Art and Life, referring to the matter of growing old, says: "She resisted to the last; concealed her wrinkles, helped her figure with judicious padding, and replaced lost teeth by artificial ones of ivory fastened with gold."

That much the same feeling of reproach attached to the wearing of artificial teeth in those days that exists at the present time is indicated by many references. St. Sauveur says in L'Antique Rome: "A poet more satirical than gallant said to a coquette of that city, 'Do not walk, do not laugh when there is too much air. The zephyr would easily lift your teeth and your hair.' . . . What a pity," adds he, "that one can not also buy eyes."

Artificial teeth have been found in the tombs of the ancient Etruscans dating as far back as six hundred years before Christ. Herodotus, the great Greek historian, speaks of the attention given to the diseases of the teeth, as well as to the eye and ear, in Egypt, and Benzoni and other writers claim to have found in Egyptian tombs artificial teeth made from ivory and wood, some of which were mounted upon gold plates. Wilkinson, in his account of the ancient Egyptians, says: "And it is a

singular fact that their dentists adopted a method not very long practised in Europe of stopping teeth with gold, proofs of which have been obtained from some mummies at Thebes." This observation by Wilkinson has received so little corroboration from other writers that the possibility of error is suggested.

Galen, who wrote in the second century after Christ, spoke of dentistry as a recognized art, but from the beginning of the Christian era until that black night of ignorance and superstition closed in upon European civilization and the dark ages of passion and vice held Europe in its grasp we have but few references to the condition of dentistry, and it is safe to assume that but little progress was made in dental science. For what little knowledge of dentistry was preserved during the dark ages we are indebted to the monks. They alone of all the people strove to keep alive within the narrow confines of their monastery walls whatever of art and science could be made to survive that long period of ignorance and gloom. Even at the present time many of the monks in Italy have a certain skill in dentistry, with which they administer to the needs of the poorer classes.

With the exception of the rather meager references to cleansing the teeth, all historical evidence points to the fact that the restoration of lost teeth by artificial substitutes was about the only form of dentistry practised by the ancients. Fortunately,

these substitutes were so crude that attention was riveted upon them and they became objects of ridicule and a reproach to the wearer. This is spoken of as fortunate, because where the substitute is inadequate or hideous it is more likely to be avoided, and to this end greater attention will be paid to the natural organs. Unfortunately, the work of restoration performed by the modern dentist is successful enough to deceive more or less effectually the casual observer, and while artificial teeth will probably always be a humiliation and a source of regret to the refined and sensitive wearer, yet the high degree of skill with which such substitutes are now made causes both patient and dentist to take chances with the natural teeth that they never would dare take were there no artificial substitutes obtainable.

To illustrate my meaning more clearly, suppose that from childhood we had been taught that diseased teeth were results of neglect and promoters of physical weakness, and that the loss of a tooth was irreparable. Suppose that we had been taught that artificial teeth interfered with natural speech, and that they ruined the natural lines of the face. Suppose we knew that the wearer of artificial teeth was annoyingly conscious of them at all times and that they did the work of mastication but indifferently. Suppose, on the other hand, we had been taught to regard the natural teeth as organs without which health and comfort would be endan-

gered. Suppose that we had been taught that decay was a harmful disease which should be eradicated by every possible means and that our teeth were essential to our future advancement. Suppose that we knew that their preservation meant freedom from discomfort as well as from many general diseases. Suppose this view, which does not exaggerate the condition in the least, had been vigorously drilled into each one of us, we should then have no more than a proper sense of the value of the natural teeth and an adequate appreciation of the discomforts attending artificial substitutes. Happily, such wholesome ideas of dental hygiene are growing more general every day.

There still exists, however, a very large class of people who, from lack of appreciation of the value of teeth, or from ignorance or poverty, persist in taking chances with their natural teeth; and there also exists—incomprehensible as it may appear—another class who look upon the natural teeth as but temporary affairs, imperfectly adapted to the uses for which they were intended, and to be gotten rid of as soon as the signs of weakness appear. Such entire misapprehension of the value of natural teeth is probably encouraged by irresponsible dentists, who find it more profitable to make false teeth than to save the natural organs, and also by the merciless operators who extract teeth by the wholesale.

The effort to repair damage and restore teeth

has been in the main a sincere and successful one; but the ease with which artificial substitutes for the natural teeth have been supplied has led to an unconscious indifference to the preservation of the organs which nature provided for mastication. The making of artificial teeth, though it is an important and worthy branch of the dentist's work, is likely to incline even the most conscientious practitioner to place too low a value upon the natural teeth; and so far has this failing reached among certain classes that it is almost to be regretted that inventive genius ever discovered a way to supply the loss of the natural organs.

It must be freely admitted that no profession has made such prodigious strides in the last fifty years as that of dentistry. The skill which has been developed is little short of marvelous when we consider that it had to be evolved from the most chaotic mass of ignorance that ever furnished the foundation for useful knowledge and skilful operations. It is to be hoped that the next twenty years, bringing as it will a broader knowledge of the human system, a better acquaintance with hygienic conditions, and an increasing interest in the preservation of the natural teeth, will do more for the advancement of dental science than all the ages that have gone before.

The uses of the teeth are first to masticate food, second to assist in the articulation of words, and third to give expression and beauty to the counte-

nance. As the subject of mastication of food will be taken up in detail in another chapter, it need not be spoken of at the present time. In the enunciation of words the teeth are indispensable. If they are not reasonably sound and perfect, words can not be clearly and distinctly articulated. This was known to the Greeks and Romans, and on this account their best speakers were exceedingly anxious to preserve their natural teeth, since artificial substitutes so inadequately answered the purpose. There are some words which can not be pronounced if the front teeth are wanting, and when all the teeth are lost the voice becomes feeble, thick, and indistinct. The monotonous cadence of edentulous old age serves to remind us of the importance of the teeth in articulate speech.

In giving expression to the countenance, no organ or set of organs has greater effect. No man can give the impression of strength or power whose teeth are frail and uncared for. His words are unheeded and his authority weakened as soon as he exhibits a weak and diseased set of teeth. Nothing so quickly rivets attention and causes such a feeling of repulsion as uncared-for teeth in a woman. How many beautiful women convey a shock and arouse a sense of pity instead of admiration when they open their mouths! Anything which will heighten the effect of these organs becomes of the first consequence to people of refined society.

Solomon, one of the wisest sovereigns of antiquity, whose court was the home of fashion and beauty, makes several complimentary allusions to beautiful teeth, as when he says, "Your teeth are like a flock of sheep even shorn, which come up from the washing." Ovid recommends as a remedy against love "to make her smile, who has bad teeth." He also said to a young lady, "I can perceive your attention to the graces by the whiteness of your teeth." Another Latin poet, in giving the portrait of one of the reigning beauties of his time, says: "How can I describe the beauty of her teeth which she presented to view in the act of laughing? White, equal, closely and compactly placed, they presented in their arrangement the effect of a fine necklace formed of pearls, the most regular and the most brilliant." Lord Chesterfield remarked that "fine and clean teeth are among the first recommendations to be met with in the common intercourse of society," and Lavater remarked, "as are a man's teeth, so is his taste." He goes on to say: "White, clean, and well-arranged teeth, visible as soon as the mouth opens, I have never met with except in good, acute, honest, candid, and faithful men."

If the learned philosopher had lived to-day he might have gone even further and announced without hesitation that strong teeth are essential to the best types of manhood, and that degeneracy of the teeth means deterioration of the race. This does not for a moment reflect upon the great number of

brilliant, kindly, and noble people who possess frail, rapidly decaying teeth that seem to be but the precursors of false teeth that follow as age advances. It can not be denied that great intellectual power is often associated with weak teeth, nor can it be denied that weak and rapidly disintegrating teeth are frequently seen in men of large stature who appear to be healthy and strong; but it can be confidently affirmed that that rare combination of vital power and physical and mental strength which is found in the best athletes, in pioneers, and in great leaders of men is rarely to be seen unaccompanied by strong teeth.

Criticism may be awakened by the attempt to classify athletes with the best types of men, since it is the opinion of certain well-meaning people that they represent brute strength alone. Nothing could be more erroneous or unfair. College statistics show that the record of athletes in their studies is fully up to the general average of college work, notwithstanding the time and absorbing attention given to their athletic sports by these young men. Furthermore, while it may be possible to teach a dullard to perform one or two feats of strength, no one but a man of alert brain, quick to see and to seize opportunities, can possibly succeed in general athletic sports. The intellectual broadening, the firmness and determination developed in wholesome outdoor games, makes the college athlete entitled to rank as one of the best types of civilized man-

hood. To such men good teeth are essential, and to them they are given.

That great men have lived, and great deeds have been accomplished in spite of the handicap with which diseased teeth load down the race, is unquestioned. We have only to remember the "Father of our Country" to satisfy ourselves on this point. It is known that George Washington wore an artificial denture, but only great genius and unusual force can combat the impairment of health and strength which normally follows the loss of teeth. There may be many who will not readily concur in this opinion, for there will flash before each one of us the picture of dear friends and relatives, and of great men and women as well, who have had poor teeth; but careful observation will discover the truth of the general proposition—that the men and women who lead in the world's progress must have strong teeth, that if you would see your children pioneers and leaders in the world's best work you must give them good teeth. Without these vitality is lowered and force is weakened. That it is possible to strengthen even the weakest teeth and preserve them from much of the decay and loss which often seems to be their natural heritage will be shown in the pages which follow.

CHAPTER II

CAUSE OF DECAY

Before considering the means by which teeth can be strengthened and decay prevented it is necessary to get fixed firmly in one's mind a definite idea of what causes dental caries or decay of the teeth. A number of theories have been advanced to explain this most troublesome and tormenting of all diseases, and it would be interesting to the dentist and to the student of dental progress to study them carefully, but for our present purposes it is safe to accept that one which from our present knowledge of science seems to explain best the destruction of the teeth. Such an explanation is found in the theory given to the world about twenty years ago by Dr. W. D. Miller, of Berlin.

To state Miller's conclusions in the simplest and briefest manner, it is only necessary to say that bacteria capable of producing lactic acid were found by him in the mouth. This acid produced by bacteria coming in contact with the teeth dissolved out the lime-salts from the enamel, and in this way started the first step in the process of decay. Then followed the destruction of the dentin or bony por-

tion of the tooth lying under the enamel, and the final destruction of the entire crown or exposed part of the tooth. It is not necessary in order to understand the matter of tooth preservation to comprehend fully all the steps in the destruction of a tooth, but it is well to remember the first step in the process, namely, the formation of lactic acid by bacteria, and the destruction of the enamel by the acid so formed.

The best testimony as to the excellence of Miller's work lies in the fact that in these kaleidoscopic times, when bacteriological discoveries are being made on every side and scientific knowledge is increasing in every branch, no one has yet arisen who has seriously assailed the conclusions reached twenty years ago by this able investigator. His theory of caries is accepted by the profession throughout the world with scarcely a dissenting voice.

It is necessary for the guidance of the dentist in his daily work that he should have a definite and satisfactory theory upon which to build the practical superstructure of dental operations, and it will be an aid to any plan of prophylaxis or preventive treatment whether adapted to the needs of the patient or dentist to have a practical working basis upon which as a foundation we can build up a satisfactory system of caring for the teeth and preventing their destruction and ultimate loss. Such a theory and such a practical basis for prevention we have found in Miller's work.

It should be carefully noted that the acid-producing bacteria which bring about the destruction of teeth, find their chief source of nourishment in starchy and saccharine foods. In every plan of preventing tooth decay this fact must be remembered. A mixture of bread, especially white bread, and saliva furnishes an excellent medium for the development of such bacteria, and if a little sugar be added to the mixture fermentation is hastened and lactic acid is produced with great rapidity.

It is undoubtedly a shock to the average layman to be told that the human mouth is a perfect hotbed of bacteria, and that from time to time it is probable that nearly every form of bacteria finds its way into the oral cavity in food and water and by means of the air, and indeed by almost everything else that enters the mouth. The habit of using the mouth as a convenient receptacle for small objects when the hands are occupied tends to increase the number and variety of bacteria entering the gateway of the body.

The thought that the mouth contains so many and so great a variety of bacteria will be less repulsive if we bear in mind that these micro-organisms are not minute animals, as is popularly supposed. There is a feeling that bacteria are microscopic dragons lurking in hidden corners and awaiting an opportunity to reach out and attack their unsuspecting victim with the poisoned fang of some loathsome disease.

Bacteria belong to the vegetable kingdom and are in many respects analogous to the higher order of plants. We have in that higher vegetable kingdom countless numbers of plants which we term weeds. These cumber the earth, and, as far as our knowledge extends, are entirely useless, though harmless. We have, it is true, a small number of noxious plants whose poisonous properties bring about disease and death; but by far the greatest number of the plants of the higher vegetable kingdom serve a useful purpose and human life could not be supported without them. So it is with bacteria which we have mistakenly come to associate with diseased conditions only. A vast number may be looked upon as useless weeds, since our present knowledge is unable to discover any office, useful or otherwise, which they perform. There are others, it is true, which if planted in the proper soil and surrounded by conditions which favor their development are known to produce disease and death. Many of these have been discovered and studied, and the guilt of others will be brought home to them as years go on; but there is already known to be a long list of useful forms of bacteria, and this list is constantly being lengthened by the discovery of other forms which play an important part in the economy of life.

Without the aid of these much maligned microorganisms life itself would speedily become extinct. The wonderful nitrifying bacteria which find their

home in the earth lay hold of and adapt to our needs the free nitrogen of the air, which, in order that we may live, we must consume and assimilate. These nitrifying bacteria take up the waste products of the barn-yard, dead leaves and other vegetable matter, and convert them into food suitable for the life of the plant. They convert nitrogenous elements into ammonia, nitrous and nitric acid, carbonic acid, and water. The organic forms of nitrogen, phosphorus, carbon, and hydrogen undergo a process of mineralization during which they are oxidized and become nitric acid (HNO_3), phosphoric acid (H_3PO_4), carbonic acid (CO_2), and water (H_2O).

The farmer, when he plows his field and harrows it and pulverizes the soil, may be ignorant of the work he is doing, but he is carefully preparing a better culture medium for the nitrifying bacteria. He loosens the soil so that light and heat may penetrate and serve for the more rapid development of these beneficent agents. The old-fashioned expression "sterile soil" may be looked upon as strictly scientific. The soil is sterile because of the absence of bacteria.

Other micro-organisms which play a useful part in life are those which cause or force the various processes of fermentation. This is so well recognized now that bacteria have become an article of commerce, and are in demand to stimulate the production of cream and butter and for other useful purposes. The work that bacteria perform in con-

nection with the filtration of water is of the greatest value. They take up and destroy the organic impurities in the water, and by their agency the water from a polluted stream can be rendered pure and even suitable for drinking purposes. Cases showing the usefulness of bacteria could be multiplied indefinitely, and the idea that we have so long held that bacteria necessarily mean disease must be abandoned.

In the human mouth there are many forms of bacteria that are so commonly found that they may be looked upon as almost indigenous. Among those forms of bacteria found more or less constantly in the mouth are many kinds which are capable of producing lactic acid under favorable conditions. Under other conditions, it must be remembered, they fail entirely to act as acid formers and may give rise to an alkaline fermentation. Thus it will be seen that for the production of caries or decay the mere presence of certain kinds of bacteria is not sufficient, but that other conditions must prevail to make these bacteria effective.

Before taking up the conditions which favor the development and increase of these destructive acid-producing bacteria, it may be well to mention some of the characteristics of bacteria in general in order that the reader may have some sort of a mental image of these interesting micro-organisms. Bacteria are unicellular masses of protoplasm and belong, as has been said, to the vegetable kingdom.

So small are they that it is difficult to form an accurate conception of their size. The micromillimeter is the measure of $\frac{1}{25000}$ of an inch. If you divide an inch into twenty-five parts, one twenty-fifth will be appreciable to the naked eye, but it is not a very wide space. If you then keep in mind that it would take a chain of one thousand fair-sized bacteria to stretch across that space you would get a pretty accurate idea of the average size of a bacterium, and you can calculate without much difficulty how many millions could dance on the head of a pin. Some are larger than this, it is true, and the rod form stretches out into two, three, four, or even more micromillimeters in length, but many of the forms are much smaller, and bacteria from the mouth are constantly met with that are less than one-half a micromillimeter in diameter.

As to the shape of these micro-organisms, the two classes which it is well always to remember are the bacillus or rod form, and the coccus or round form. These are the two important divisions that one hears constantly spoken of. The spirilla are curved rods, as are the vibrios. The coccus form occurs singly or in pairs or in groups or in chains. When in pairs we speak of the diplococcus form, when in groups of the staphylococcus form, and when in chains they are known as the streptococcus form. To the streptococcus form is ascribed many malignant effects, and they are always under suspicion.

Bacteria multiply by two different methods: by

what is called fission or division of the original cell, and by the production of spores which have been likened to seeds of the higher vegetable world.

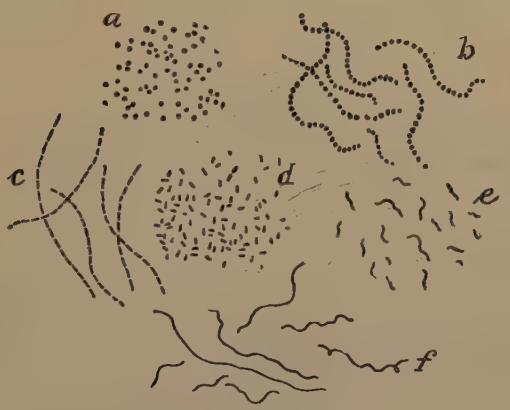


FIG. 1.—Bacteria. *a*, cocci ; *b*, streptococci ; *c*, bacilli in chains ; *d*, bacilli ; *e*, spirilla ; *f*, spirochetæ and thread forms.

These spores are, however, really bacteria in a condition of arrested development. They are extremely resistant to heat and to chemical action. The process of fission is carried on with great rapidity, and in a suitable soil or medium for cultivation the rapidity is almost incomprehensible. A single cell, it is estimated, may produce in twenty-four hours over sixteen million, and in forty-eight hours the number is estimated at 280,500,000,000. If this were to go on all space would be filled with bacteria,

but fortunately the seed does not always fall on good ground.

In the mouth it is possible for us to control in some measure the rapidity with which bacteria de-

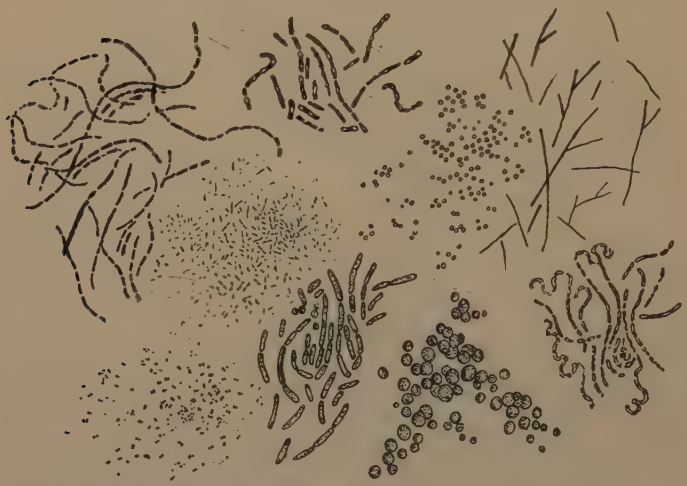


FIG. 2.—Micro-organisms commonly found in the human mouth. Magnified about 700 diameters.

velop. This can not be done by antiseptics or mouth-washes alone, as experiments have shown. Röse (Zeitschrift für Hygiene, 1901) has recently announced the results of certain experiments made with corrosive sublimate of the strength of one to five hundred. Corrosive sublimate is the strongest of all antiseptics, and on account of its poisonous

properties should never be used as a mouth-wash. In the experiments by Röse the number of bacteria in the mouth were carefully estimated, and then the mouth was carefully washed with corrosive sublimate of the strength of one to five hundred. Nearly all the bacteria seemed to be killed. Yet in fifteen minutes 9 per cent of these bacteria had developed, and in two and one-half hours 23 per cent had developed, and at the end of four and one-half hours 75 per cent of the original number were found in the mouth. It will be seen that strong antiseptics alone, even if suitable non-poisonous ones could be found, can not be relied upon to control bacterial activity in the mouth. The author's experiments tend to confirm the views of Röse.

On the other hand, it can be readily shown that thorough mastication reduces the number of bacteria in the mouth. By the act of vigorous chewing they are brushed off the teeth and out of their resting-places and are mixed with the masticated food and carried into the stomach, to be destroyed by the acid of the healthy gastric juices. After a meal—particularly one which consists of food requiring prolonged mastication — bacteria will be found much less abundant than before the meal. Shortly after the meal they begin again to increase, and continue to do so until the beginning of the next meal, when they are again found in greatest numbers. If, however, the mouth is well cleansed

and the food particles carefully washed out immediately after the meal, the increase in bacteria is greatly lessened, and if the saliva is normal and the teeth and mucous membrane are in a healthy condition the development of bacteria will be greatly retarded.

If starchy food, like bread, crackers, et cetera, is allowed to remain in the mouth, it will greatly enhance the development of the acid-producing bacteria which have been found so destructive to the teeth. This effect is also produced by saccharine food, like sugar, candy, and other sweets. Any one who has a slight knowledge of bacteriological work can readily confirm these experiments and satisfy himself as to the statements, all of which point to the conclusion that keeping the mouth clean by frequent and careful removal of food retards the growth of bacteria because it reduces the soil in which these microscopic plants develop. When the mouth is kept free from starchy and saccharine foods it deprives the acid producers of the elements needed for their growth.

Besides protecting the teeth, such cleanliness reduces the likelihood of acquiring other diseases. It is evident that if disease germs enter a neglected mouth and find unwholesome conditions of the mouth and mucous membrane, if food particles in all stages of decomposition abound which serve as a soil for their development, they will

grow in numbers and in virulence much more rapidly than in a clean, well-cared-for mouth. A clean mouth is an important safeguard against disease.

It has naturally suggested itself to the reader that if decay or caries of the teeth is the result of an acid, why is not the remedy an alkaline tooth-wash. Here we are confronted with one of those apparent contradictions that make bacteriological study both difficult and discouraging. Acid-producing bacteria develop best in an alkaline medium and stop developing when the substance in which they are growing becomes acid and the strength of the acid reaches slightly above one-half of one per cent. They are victims of their own industry and are killed by the acid which they produce. It is found that the saliva of those patients in whose mouths the process of caries is going on most rapidly is generally alkaline. Acid saliva is met with only occasionally, and is not usually accompanied by any marked carious action. Therefore an alkaline tooth-wash, useful though such a preparation may be, can not be looked upon as the much sought after agent that will eliminate caries from the catalogue of human ills.

It will be found also that the saliva of some mouths makes a better culture medium or soil for the cultivation of bacteria than saliva taken from other mouths. This is a subject too complicated to

be treated in such a work as this, but it points out clearly the fact that there are many considerations other than the mere presence of bacteria which must be taken into account in explaining the decay of teeth.

CHAPTER III

PREDISPOSING CAUSES—LACK OF EXERCISE

An important consideration in accounting for caries or tooth decay is the resisting power latent in the teeth themselves. That teeth differ in their susceptibility to decay is shown when caries is produced artificially in the laboratory. If a dozen teeth are put in the same tube and acted upon by the same bacteria some teeth will show marked decay, while others will be unchanged. Repeated experiments seem to show that some teeth are much more resistant to decay than others. The majority of practising dentists will assure us that the same is true of teeth in the human mouth, that whereas the teeth of one patient yield readily to carious action, the teeth of others are extremely resistant, and if decay goes on at all the process is a slow one. This view of susceptibility and immunity is by no means universal. Many good authorities believe that no difference in tooth structure can have any bearing on the question. There is much to be said on both sides. We know that we can not quite explain these supposed differences in teeth, for they are apparent-

ly too obscure to be easily understood; nor can we quite tell why one man catches pneumonia while his companion, exposed to the same conditions, can not get it if he tries. It is the same with all diseases. The influences which make one man's lungs or throat or liver, or what you will, more susceptible to disease than similar organs in other men are too subtle to be shown by any physical signs or even by the microscope or by chemical analysis, if such examinations could be made, and yet there can be no question of the existence of such influences.

It would perhaps be better to compare the teeth with the hair and skin, as all these are of the same epithelial structure. Why the hair of one person falls out at an early age, why the complexion of another is marked by eruptions that baffle the most skilful physician, why the teeth of another are seemingly frail and easily attacked by the influences which produce decay, are questions which puzzle the most careful student. If we understood better the wonderful chemistry of digestion and assimilation, we could perhaps throw more light on these troublesome questions. We know in a general way that good health, the result of simple food, sunlight, exercise, and healthy repose in well-ventilated rooms, will go far toward improving all of these conditions, and we know that attentive interest and conscientious care will often bring about remarkable cures.

In the case of teeth, it may be said in a general

way that they suffer from a lack of nutrition and from a lack of exercise. How one proposition is contained in the other will be explained in a later chapter. In addition to this lack they suffer also from a lack of surface polish, which would make them more resistant to the action of bacteria and their acid products. All three of these conditions are interdependent and can not be separated readily, and each one is largely the result of civilized methods of selecting and preparing food. When it is said that decay of the teeth is brought about by civilization, it is not intended to assert that caries was unknown among uncivilized races, but the information that any fair-minded observer will gather from a brief study of the skulls of uncivilized races in the Peabody Museum in Cambridge, and in other museums where such collections are preserved, must convince him of the truth of the general proposition that dental caries is the result as it is the curse of modern civilization.

Undoubtedly it is also true that ancient civilization was less afflicted than is civilized man at the present time. This we are forced to believe from an inspection of the skulls found in the Catacombs and by a study of the teeth of mummies. Thousands of the latter have been exhumed in the past few years, and while, unfortunately, the teeth of those mummies which were examined have not received the careful attention they deserve, yet whenever they have been examined and studied they have

excited admiration for their general excellence. We know not only that teeth have deteriorated, but we know that there has been a narrowing of the jaw, which has steadily increased until now it is becoming so marked as to excite notice and cause justifiable alarm. The primary causes which have led to the deterioration of the teeth have probably also caused the narrowing of the jaw, and these causes are to be found in a loss of functional activity or lack of use.

There is a great deal of modern cant which ascribes everything to evolution. But evolution in man differs from evolution among the lower animals in this—that ever since man turned his back upon the ancestral ape and began to be guided by reason instead of instinct, his evolution has been largely in his own hands. Thought was never more supreme than it is at the present time, and if we want a thing, and want it badly enough, it will be evolved to supply our wants.

If it is true that the teeth are necessarily doomed, that resistance is useless, and that an edentulous race is the inevitable sequence of civilization and progress, then it must follow that the highest mark of civilization is the narrow receding jaw containing rapidly decaying teeth. It would be equally logical to believe that the greatest blessing which we could bestow upon our children would be to give them the weakest teeth imaginable, or if possible no teeth at all, so that they and their children may

be the first to arrive at that most advanced condition of civilization—the edentulous state.

It would also be true if evolution had marked the teeth for destruction, that the best practise would consist in extracting any and all of the teeth whenever the opportunity offered. We should then look upon the teeth, as we now look upon the vermiform appendix—as organs that have lost their usefulness and are a menace to health.

These suggestions are as logical as they are abhorrent. The picture seems exaggerated, but ignorance and indifference might easily bring about such an attitude of mind if considerations of health and comfort did not intervene to prevent it. Following the loss of the teeth the absorption of the lower jaw would soon take place, and in a few thousand years a race with merely a hole in the face into which liquid food could be poured would be evolved.

The suggestion that the teeth must yield to an irresistible wave of evolution is the result of sheer laziness and an inadequate conception of the causes that weaken teeth. Chief among these causes is lack of exercise. You can render an arm thin and weak by keeping it practically motionless for a few months, or you can make it large, strong, and healthy in a comparatively short period by devoting a small amount of time to daily exercise of a regular and proper kind. When the statement was made that decay was largely dependent upon modern cookery, the meaning implied was that as food is

now prepared for the table it requires little or no chewing, and we have consequently lost in a great measure the habit of mastication and the strength of the masticatory muscles has diminished. When food does not melt in the mouth we wash it down with a draft of water or tea or coffee, and our children are permitted to do the same. It isn't any great wonder that the teeth become weak, that the muscles which control the movements of the jaw lose their strength and grow tired if called upon for any prolonged effort. It is not remarkable that the lower jaw retracts and becomes small and narrow when there is insufficient exercise to encourage its development.

If children could be sent to a chewing school as they are now sent to a kindergarten, there would be a marked improvement in the race. In the nursery, or indeed when the child graduates from the nursery and comes to the family table, there is but little food which affords any exercise for the teeth and muscles of mastication, and there is but little advice or encouragement given to induce children to chew their food properly. The average meal for the average child is likely to be a bore and he hurries through it, washing his food down with water in order to seek a more congenial occupation. The nervous energy of modern life, especially in America, is somewhat responsible for this condition. Life is so crowded that nervous haste is the rule rather than the exception. Repose is almost un-

known except during the hours of sleep, and even the meal hour is shortened under pressure of other matters.

To produce strong teeth is almost as simple a matter as to produce strong arms. To accomplish this, however, it is necessary to see that the children have at each meal some wholesome article of food that calls for vigorous mastication and to see that it is thoroughly masticated. If this plan is persisted in, the habit will soon become established so that it will never be forgotten. Bills for dentistry will be reduced, the child's teeth will become strong and well polished, and there will be a distinct enlargement of the jaw and a strengthening of the facial muscles. There can be no exaggeration of the marvelous results achieved by vigorous mastication. Indeed, the fear of appearing too radical and the danger of overstating the advantages gained by exercise leads rather to an underestimation of the value of this hygienic measure.

It is because uncivilized races live upon food that is tough and but imperfectly cooked, and which requires a great deal of chewing, that they are invariably shown to have excellent teeth, free from irregularities, and firmly implanted in wide jaws, to which are attached strong facial muscles. It matters not apparently whether they live on a diet chiefly animal in its composition or on a vegetable diet. Their food is imperfectly cleaned; it

usually contains sand and grit, which serves to polish their teeth, and their cookery leaves many a tough fiber to be ground into pulp. Their only method of preserving food is by drying it, and food so preserved, whether it is animal or vegetable, becomes exceedingly tough and hard and requires hours of faithful mastication before it can be swallowed. The savage does not necessarily enjoy the laborious work of chewing, and probably does not do any more than he is really obliged to, but with him it is a question of life and death. It would choke him to death to attempt to swallow his food without proper mastication, and he must either chew or starve.

If a savage race could be found that had lived for generations entirely on soft food I should expect to discover an edentulous tribe. At the present time the Eskimos are noted for the strength of their teeth, yet their lives are passed under conditions far from hygienic. Caries or decay is almost unknown among them, but it is not uncommon to find the teeth of the aged worn down to the gum margins, showing the enormous use they must have made of the teeth in preparing their food for stomach digestion.

Exercise causes the blood-vessels to take up the waste material which has served to nourish the part, and when this is taken up fresh material is brought to nourish and strengthen it. It is perfectly obvious that no matter how abundant the food supply

may be, no matter how rich the blood is in nutrient material, no matter how well adapted that nutrient material is to the needs of a given part of the body, yet unless sufficient exercise is taken the nutrient pabulum will not be taken up because the waste material can not be expelled to make room for it. This applies equally to the arm or to the teeth or to any other portion of the body.

If, however, the food taken into the system be insufficient, or if sufficient in quantity it fails to contain enough nourishment for the entire body, the condition is much more serious, and that organ or that part of the body which is least used will suffer most from the scarcity of nutrient pabulum. At first glance it would seem as if the contrary were true, and that an idle member would suffer least when the nutrient supply was inadequate, but a second thought will establish the truth of the statement that the parts which have normal exercise are best able to resist the disastrous effects of improper or insufficient nutrition. The nourishment of an organ depends upon the activity of the protoplasm of which it is made up. As the nutrition perfectly suitable in quality for a particular kind of tissue, but in such reduced quantities that there is not enough for every organ which needs it—when this nutrition goes coursing through the minute blood-vessels of the body every molecule of protoplasm which requires this nutrition must abstract it from the blood. Now, if by exercise the protoplasm of a part

is rendered active, it will take up all the nutrition it needs, or at least all that it can get, and if there is not enough for all, the idle protoplasmic cells in the unused part of the body will be robbed of their entire portion by the more active cells. This explains the importance of exercise.

The power of selection or differentiation inherent in the protoplasmic cell is almost as great a marvel as the wonderful mystery of creation itself. From the extremely complicated nutrient pabulum which results from the digestion of food the protoplasm of a bone selects that which is necessary to nourish the bone, the protoplasm of muscle neglects everything save material needed for muscular development, while the hair and the skin and the teeth have each its own protoplasm selecting the nutriment needed for each particular part.

Some interesting experiments have been made at various times and places by different observers which show plainly the importance of exercise as a factor in nutrition. Animals were fed for a long period on foods deficient in lime-salts, and were finally killed. Examinations were made of their different bones, and the results were carefully noted. It was found that the bones which had little exercise, such as the bones of the head, showed the effect of the loss of lime-salts much more plainly than the active bones. In many instances the fixed bones were so thin that death would have ultimately re-

sulted from their absorption, while the bones in active use showed but little change, they having robbed the blood of all material suitable for their maintenance.

Unfortunately in these experiments the teeth have not received the measure of attention which they deserve, and as they are extremely dense, and as changes go on much more slowly than in other parts of the body, they have not been taken into account when nutrient changes have been studied or when experiments have been made with the object of determining the value of various kinds of foods. We have, however, so many examples of deterioration of teeth when nutrition is interfered with that too much stress can not be laid upon the importance of promoting the strength and vigor of these useful members by wholesome, natural exercise.

The question that naturally arises is, Why is not the remedy to be found in gum chewing? It does not reflect credit upon the business acumen of the six-million-dollar chewing-gum trust that it has not made use of these suggestions in advertising its wares. Chewing-gum warranted to restore weak and diseased teeth to health and vigor would be an alluring bait to catch the fleeting nickel. The truth is that the constant chewing of gum overtaxes the salivary glands to such a degree that they do not respond to the normal stimulus of food when it is taken, and as a consequence large

quantities of liquid must be taken at meals to supply the loss. The stomach is irritated by the unusual quantity of saliva swallowed between meals, and digestive disturbances are the common result of indulgence in this objectionable practise.

If, as has been shown, a generous amount of mastication will strengthen mature teeth and protect them against decay, how much more important this function must be in early life when the teeth are developing. The germs of all the teeth, both temporary and permanent, are present when the child is born. The work of tooth forming has already begun, and in the mysterious laboratory of the human body the busy protoplasmic cells of each organ are laboring night and day, discarding that which is unfit and selecting that which is useful to the building up of the particular organ of which they are a part. Unerringly the marvelous changes are wrought, and all that nature asks is an opportunity to do her best. Given the raw materials in the shape of wholesome food, given a bountiful supply of oxygen, plenty of sunshine and reasonable and natural exercise with healthy normal sleep, and provided that ancestral sins are not visited upon the child in the shape of some inherited diathesis or taint, a healthy child will be developed. Neglect any organ or let anything interfere to cut off its nutrient supply, and the consequences will follow the child through life.

It is not the purpose of this work to advocate a

particular diet, but merely to call attention to the fact that the mere presence of teeth in the mouth cries aloud for such a modification of the diet of the child as will produce in them functional activity. Even the little temporary teeth must have a goodly amount of exercise, since exercise insures a bountiful blood supply, and upon this depends not only their own preservation and usefulness, but also the size and shape of the jaw and texture of the permanent teeth which follow. All are influenced by the use or neglect of these tiny teeth. While the jaw is undeveloped and the bones soft, it is obvious that it is more susceptible to the various influences which affect its growth than after full development has taken place; and exercise during this early period will do much to insure its proper development. The permanent teeth still in the formative period will also profit by the increased nutrition which exercise will bring. Even after eruption the permanent teeth are not completely formed. The pulp-chamber and root-canal are large and the end of the root is not complete. Lime-salts continue to be deposited for many years, and the teeth can hardly be said to be fully formed before the age of twenty-five. Indeed, lime-salts often continue to fill up the pulp-chamber and root-canals, until in old age we find both nearly obliterated and the tooth an almost solid body.

In addition to the increase of strength which comes to the teeth from vigorous use they are bene-

fited by the external polish which they acquire from the rubbing of tough food against their surfaces. Dr. G. O. Mills called attention years ago to the high polish which it was possible for a tooth to acquire, and it was made perfectly obvious that teeth so treated were infinitely better fitted to resist decay than others with a dull or rough surface. Bacteria will not cling to the highly polished surface, nor will the action of acids be felt as on the dull unpolished tooth.

Besides benefiting the teeth and jaws mastication, if properly performed, stimulates the glands of the mouth to healthy action and the saliva is rendered clear and normal. Such saliva mixes readily with the food, and a small amount will convert an almost unlimited amount of starch into sugar and assist materially in digestion. Sluggish glands bring forth unhealthy secretions. It is scarcely necessary to refer to the effect of mastication upon stomach digestion, since it is pretty generally conceded that a large number of all diseases of the stomach and of other disturbances of the digestive tract come from bolting the food. As has been seen, it is in the early formative period that we can do most to influence the future of the teeth.

If our inertia could be overcome and these young teeth could be given the modicum of systematic attention which they deserve dental operations would be reduced to a minimum, and the ap-

pearance of these little ones would be wonderfully improved. The protruding forehead and the receding lower jaw may indicate intellectuality, but we can never regard them as marks of beauty nor can we desire them for our children.

CHAPTER IV

FOOD

When the feeding of a child is spoken of every mother pricks up her ears and we are met with the question "What would you advise?" If a direct answer could be given to this question and a specific food suited to the needs of her child could be supplied, every mother in the land would be quick to avail herself of its advantages. It is this readiness to try everything that promises immediate results which makes the enormous sale of infant foods possible. Published testimonials from people who are not competent to judge of their values and attractive pictures of fat babies are sufficient to sell tons upon tons of these so-called health foods. Many of these foods probably serve a useful purpose, and apparently a number of infant lives have been saved by their use. It is probable, however, that the vast majority of cases so treated would have shown a more pronounced improvement if a *régime* of natural foods had been substituted for that prepared in the laboratory of the manufacturer. Prepared food is widely used because it is easy to procure, while a proper ration for a sick or delicate child must come as a result of

most careful study by a physician well versed in his calling. It must also be modified to suit the changing conditions which arise in the life of a growing child, and must be varied to suit different children as well.

The testimony of dentists will show that it is unusual to find healthy teeth in the mouth of a child who has been brought up on one or more of the prepared infant foods. It is discouraging that this is so, for if any one food could be confidently recommended a direct answer could be given to the mother's inquiry when she asks "What would you advise?" As the matter stands to-day the questions of digestion and assimilation are of more importance than the selection of particular foods for the upbuilding of particular organs. Attempts to stimulate the growth of a particular part of the body by means of a specific food have not met with marked success. Digestion and assimilation are as much dependent upon fresh air, exercise, and restful sleep as upon the food itself, and any suggestion as to feeding must be based upon the assumption that hygienic principles have faithful adherence.

Of course, consideration of the question of food for the child's nutrition should begin with the mother before the child is born. That she should be bountifully nourished and supplied with every hygienic aid that science can suggest goes without saying. The health of the child for years to follow may depend upon the proper nutrition of the

mother at this time. The influence of the dentist, however, usually begins after the child is born, and may be deferred until some digestive irregularity affecting the teeth drives the parent to seek professional advice. It is unusual for the dentist to see a child before the child is three or four years old.

If up to this time the child has been well nourished, passing from the maternal font to good cow's milk and to other wholesome foods, but slight obstruction will probably be offered to the carrying out of a systematic plan for improving the nutrition of the body, and of the teeth in particular. If, on the other hand, the child has been fed since birth on one or more of the various patent foods, there will probably be found a condition of the body, and especially of the teeth, that will presage a troublesome future for the child which will call for all our wisdom and ingenuity to prevent.

The term "metabolism" is given to the chemical and physical changes which go on in the body, and these obey the laws governing the conservation of matter and energy. The fuel under the boiler has its value determined by the amount of heat it can produce. This heat is measured by the degrees of temperature to which the water is raised. This water in turn is converted into power and measured by so-called horse-power. The nutritive value of food is also measured by the amount of energy or heat into which it can be converted. The unit of

measure is known as a calory. The amount of heat which will raise one kilogram of water one degree centigrade is one calory. Food values for ordinary purposes, such as muscular effort and endurance, can usually be accurately determined by this measure, but unfortunately this system gives no clue to the value of food as a builder of bone and teeth.

We have, however, certain experiments which may throw light on this subject, and among them are those which relate to the feeding of animals. During these experiments, which have been repeated until the accuracy of the conclusions has been established beyond question, animals were fed on food lacking in mineral salts. After a time such food became so repugnant that the animals died of starvation rather than eat it, and the attempt to supply these mineral salts artificially or medicinally was unsuccessful. It would seem from these experiments that in order that assimilation may go on undisturbed the tissue builders must be contained in the food itself.

We know that grain grown upon lands rich in calcium salts is of vastly greater nutritive value than that grown upon poor and exhausted lands, although the appearance of the grains may give no clue to the existing differences. The prolonged feeding of animals upon grains deficient in calcium salts will show itself in a weakening of the bones. Observations made of the teeth of a large number of school-children in Sweden show that in the lime re-

gions where the grains contain a high percentage of calcium salts the teeth are very much stronger than in the lower countries where the land is not so rich in lime. Thus it can be seen that whereas the lime-salts which are so essential to the teeth are not usually taken into account in experiments determining food value as measured by calories, yet they must be abundantly supplied.

Food rations, be they ever so accurate, are useless for domestic purposes. We resent any curtailment of our right to select our own food, and no ration could be prepared that would suit the various ages and various appetites of an average family. Where large bodies of men are vigorously employed, as in the army, food rations are possible; but even then care must be taken to make frequent changes, lest the monotony of the diet makes it repulsive. It is fortunate, therefore, that the lime-salts needed for the upbuilding of the tooth structures are generally contained in simple, natural, and easily digested foods. The cereals—wheat, rye, oats, et cetera—are most of them rich in the ingredients needed for the teeth, and unless these ingredients are destroyed in the process of preparing these cereals for market they furnish abundant nutrition for the bones and teeth, provided intelligent use is made of them. The same can be said of milk and many of the fruits and vegetables. The question of meat is left out of consideration for the present because the tendency is to feed too much rather than too little, but in a

general way it may be said of meat also that if it is to be fed to children at all it is better that it should be given as properly cooked beef or mutton rather than in the concentrated form of meat extracts and juices.

The tendency is to modify or to concentrate all of our natural foods. That milk can be modified to suit the needs of particular children has been attested by no less eminent an authority than Dr. T. M. Rotch, but it is probable that an average child will thrive better on pure clean milk that has not been changed than on milk that has undergone any modification. Many are of the opinion that preserving milk by heat lessens its nutritive value, while Dr. Charles Harrington, in his excellent work on hygiene, distinctly states that the preservation of milk by the addition of antiseptics is unnecessary and unjustifiable. In the preparation of grains for food the modification or alteration has gone on to an extent that is inconceivable, and especially is this true of wheat when it is converted into flour.

In Massachusetts there is a law governing the preparation of food for animals, and such foods when put upon the market are sold under a guarantee of their feeding value. Inspectors are employed to see that the foods thus offered for sale answer to the required standard. If the phosphates were removed from the food prepared for the use of cattle it would be indignantly denounced as a fraud, and yet that is exactly what is done in the preparation

of our finest flours. Although it may be shown that such flour is as nourishing measured by heat calories as the whole-wheat flour, it is a well-known fact that no animal could be fed for any prolonged period on such a diet without the effect showing itself in a marked deterioration of the bones and teeth.

Reference has been made to the difference in the quality of wheat grown on different soils, and we find that the same is true of all plant life. The difference in the appearance and nutritive value of fruits and vegetables grown on different soils is obvious. The simple explanation that one soil is better supplied than another with all the ingredients necessary for plant life suggests itself at once. The best soil is the natural or virgin soil, and when this has had its various ingredients used up it is usual either to move on to a new and unused soil or repair the loss as nearly as possible with fertilizers. It is exactly the same in the feeding of human beings, and most emphatically the case in the feeding of children. The food of the child, like the food for the plant, must contain all the ingredients necessary for its perfect development, if it is to become robust.

The more we depart from the natural foods the greater the need for complicated study to supply the lost ingredients. As has been pointed out when referring to animals deprived of minerals in their foods, it is most difficult to supply this loss by giving the missing ingredients medicinally. So it is in the feeding of children, the addition of phosphates to

the food in artificial or medicinal form can not possibly make up the loss when the natural food is deprived of its normal mineral ingredients. This must not be construed into an attack upon the modification of food by the intelligent physician to suit the needs of his patients. He usually has a variety of pathological conditions to deal with. We have but one disease to consider, and that one is caries of the teeth, and for its prevention, and for the building up of strong teeth that will resist this disease, a diet in which natural foods have an important place is found to be extremely helpful.

Just what is meant by natural foods may be illustrated by referring again to wheat, which, perhaps more nearly than any other one vegetable product, answers to all the requirements of the body. In the process of making fine wheat-flour the outside layers of the wheat kernel are discarded. It is then no longer a natural food. The portions richest in lime-salts essential for tooth building have been cast aside and lost. It is true that the extreme outside coating of a wheat kernel has no nutritive value and may be omitted without lessening the value of wheat as a nourisher of the body, yet it has a value in increasing the activity of the intestines and relieving constipation, which is one of the curses of modern life. Within this extreme outside coating are two other layers extremely rich in phosphates, and these are the most valuable as nourishers of bone and teeth, yet these also are cast aside in

order that the flour may look white and make white bread, which is considered more pleasing to the eye as well as to the palate. So general is the use of fine flour that there is just cause to fear that "the bolting-cloth of the miller will become the shroud of the American people."

In order to adhere to a diet of natural foods, it is not necessary, as has been suggested by scoffers, to eat the shells of nuts nor the skins of fruits nor the husks of grain. The intelligence of the most primitive races taught them better than that, and, happily, they were spared the unnatural longing for unnatural food. The oatmeal that is used so widely as a breakfast food is a natural food in itself. It is still a natural food when eaten with that other natural product, milk. It ceases to be a natural food when to this natural combination is added an inordinate quantity of manufactured sugar. Serious digestive disturbances frequently result from overindulgence in this mixture.

It is probable that the craving for sugar by a child is unnatural and acquired. It is usually begun by making sugar a bribe or a reward. The fond parent or irresponsible nurse stands over the child and says "See the nice sugar for baby," or something equally foolish, and proceeds to scatter it on the food as a bribe to stop the child's crying or to induce him to hurry the meal or possibly to eat more food. Undue importance is attached to the sugar, and there is just the suspicion of sin about it

which leads to an unnatural craving for it not unlike the craving for alcohol by the drunkard. A child does not naturally crave sugar, and if he is left to his own devices would be more often attracted by the salt bowl (the desire for salt being a perfectly natural craving) than by the sugar bowl, if the two were placed side by side.

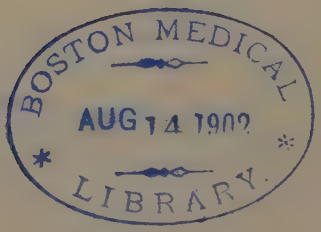
This does not mean that sugar is not an important and essential ingredient in the diet of a child, but simply that the normal requirements of the body for sugar can be amply supplied by natural foods, and that if a child did not learn in the nursery or from his playmates of the existence of sugar and candy, and if an exaggerated importance were not given to the idea of eating it, he would never crave it or suffer from its lack. There is an abundant supply of sugar in milk, fruits, and vegetables for all the needs of the body, and these can usually be bountifully supplied without injury to the child.

Meat is a natural food, and when properly cooked serves a useful purpose, but meat extracts and meat juices are artificial, and should only be given on the advice of a physician. Such concentrated food acts as would an undue quantity of oats given to a spirited horse or alcohol given to a man, and has a tendency to stimulate the child unnaturally, and to make him old before his time. Moreover, meat and many of the other natural foods give an opportunity for mastication which plays such an important part in developing strong teeth.

Furthermore, in selecting natural foods, we run less risk of adulteration.

To adulterate food or to deprive it of its nutritive value is an outrageous crime, and is the more heinous because it is so often perpetrated against unsuspecting childhood.

State and national laws are beginning to be directed against the adulteration of foods, and in due course of time the attention of lawmakers may be directed to the injustice of reducing the nutritive value of food in its manufacture. It does not seem fair to make the public, and particularly the poorer classes, pay high prices for a flour, for instance, that is less valuable for food purposes than one of the cheaper grades, and yet this is what is being done daily under a blind misapprehension of the fact that fine flour is not a natural food. "Man can not live by bread alone" in these days of bolted flour.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CHAPTER V

FOOD (*continued*)

It has been noticed that the few Syrians who come to this country have nearly perfect teeth. They are, as a rule, very poor, and many of them have never tasted meat in their lives. They are never free from unhygienic influences, but their teeth are nearly perfect. How they will be after a few years' sojourn in this country will probably depend upon whether they adopt the customs of this country and live on white bread and soft foods, or whether they will be able to obtain and adhere to their former diet of whole wheat, fruit, and vegetables. These, we are assured, constitute their entire diet in their native land.

The general excellence of the teeth of mummies has already been referred to. As if to enlighten us as to how these wonderful dentures were developed and maintained, kernels of wheat have been found in the tombs from which the bodies were taken. These were planted under the supervision of the chief of the Department of Agriculture, and were found to have retained their vitality. The skulls of extinct mound-builders show remarkable

uniformity in the excellence of their teeth. Long before Columbus set foot on these shores mound-builders had flourished in Ohio and the neighboring territory. They lived their simple lives and passed away long before the first white man appeared, but their teeth show unmistakably how simple and natural their lives must have been. The prehistoric races in Peru possessed a high degree of civilization. That they enjoyed a knowledge of many arts and sciences is attested by many archeological discoveries. The skulls of these people, perfectly preserved by their embalming processes, give evidence of complete and perfect sets of teeth. From all the knowledge that can be obtained from the rude utensils used for grinding their grain, and from other indications, it would appear that all these good people lived for the most part upon natural foods, and did sufficient chewing to keep their teeth in perfect order.

The Ashanti negro, the Hottentot, the aborigines of North America, if the evidence obtained from exhumed skulls can be relied upon, all had good teeth until the blessings of civilization were thrust upon them. In our anxiety to free ourselves from the trammels of barbarism we have carried the refining process in our food to a ridiculous and injurious extent. If our boasted superiority and intelligence is to avail to make life more charming, more beautiful, and more worthy of being lived, it would seem as if its greatest effort should be directed to-

ward the strengthening of the body and the preservation of health.

It would appear, however, that the very simplicity of the solution has made civilization averse to the consideration of the problem of how to keep well. We have been taught that to be good was to be happy, but the tiresome monotony of happiness procured by this uninspiring *régime* has led us to risk an occasional indulgence in sin, particularly when we felt that our punishment might be indefinitely postponed, if not escaped altogether. The very simplicity of the laws of health engenders a desire to break them, and because the punishment does not immediately follow and our fracture of the law result in quickly following illness, we are led to take chances with our health that we should never think of taking if our punishment were meted out immediately upon the breaking of the law. We have such sublime confidence in the power of scientific medicine to restore us to our normal condition that we do not feel greatly disturbed at the possible consequences of a violation of the laws of health. Indeed, our confidence in the physician is so great that in the matter of food and drink self-indulgence is the rule rather than the exception. In the same way our confidence in the ability of the dentist leads to our neglect of the means by which dental operations may be avoided.

The habits of a lifetime can not be changed readily, even though the benefit derived from

such a change can be demonstrated mathematically to be great enough to warrant any sacrifice. It is therefore not expected that these suggestions will be of especial assistance to people of mature years. That an immense improvement can be made in mature teeth, however, has been demonstrated repeatedly. Every dentist is familiar with such cases, but perhaps the recital of one or two may emphasize the fact that even the teeth of adults may improve in such a way as to repay careful treatment. One case that illustrates the improvement of mature teeth under hygienic treatment was that of a lady of refinement, noted for her charming personality and excellent dinners. At thirty-eight her teeth had been repeatedly filled at the gum margins and upon the approximal surfaces as well as on the grinding surfaces. When the examination was made at the beginning of the treatment there were found to be thirty-one distinct marks of decay which required treatment—that is, thirty-one fillings were required in these much-filled teeth. This report naturally drove her almost to despair, for she abhorred the idea of wearing false teeth, which meant to her the loss of charm and the loss of power as well. The author explained carefully the possibility of improvement which a persistent course of treatment might bring about, and the patient became most willing and conscientious in carrying out that treatment.

Natural foods, cereals, fruit, green vegetables,

milk, and meat formed the chief articles of her diet, and it was insisted that at every meal there should be some article of food which would require prolonged mastication. It might be shredded wheat or hard rye bread or whole-wheat biscuit or tough meat, but something requiring a prolonged effort to masticate was prescribed for every meal. Candy and sweet biscuits were prohibited entirely. She had never intentionally neglected the cleansing of her teeth, but she was urged to take especial care of them, and lest her attention be diverted from the task, she was asked to stand before a looking-glass while she was brushing them. This she did after every meal when she did not lunch or dine out, and of course she was most careful to cleanse the mouth and teeth before going to bed at night. After the teeth had been carefully filled and put in order they were thoroughly polished with a stick and pumice, and also with finer powders every month for five months. During this time three slight defects showed themselves, but these were repaired by slight operations.

Following this came an anxious period of six months, during which the patient was traveling with an invalid husband and had no opportunity to consult a dentist. She did, however, as far as the restrictions of travel would allow, follow conscientiously the instructions which had been given her in regard to diet and cleansing, with the result that when she arrived in Boston, after six months

absence, the author found a marked improvement in the general condition of the teeth, although it must be confessed that there were five requiring slight repairs. Relaxation from mental strain caused by the restoration of her husband to health and the better opportunities for care and treatment afforded by her return to her own home, led to a still further improvement. Reference to the author's notes shows that treatment was begun in September, 1896. The record of the last two years shows that three repairs only have been made. The gums are healthy, the teeth are well polished, and there is no sign of a recurrence of the former trouble. Appointments for examination and polishing are still made every three months. The seemingly enormous bill for the earlier operations has been offset by the minimum charges of the last few years.

Another case was that of a man of excellent physique who, when first seen, had just returned from a five years' sojourn in St. Petersburg. An idea of the apparent hopelessness of this case is conveyed by the fact that it was necessary to cut off three broken teeth and replace them with artificial crowns. One middle incisor was dead and required root treatment and filling, and thirteen other teeth required fillings, many of which were of large size. Exactly the same course was pursued as in the case previously noted, and the same hearty cooperation and conscientious care on the part of the pa-

tient was obtained. An inflammation in one of the crowned teeth occurred and necessitated further treatment two years after the crown was put on, but with this exception no inflammation has occurred in any of the dead teeth. Several teeth that it was deemed wise to fill with soft filling when the case was first seen have subsequently received permanent fillings. To-day, after six years' treatment, the teeth are well polished, clean, and free from all signs of decay. The gums, which were congested and swollen when the case was first seen, are now in a healthy condition. One new cavity only has occurred in eighteen months, and this was, of course, detected when it was very small.

It is probable that these results could be obtained in a majority of cases if it were possible to secure the willing cooperation of the patient. Such a course of treatment imposes considerable hardship and self-restraint on the patient, and a certain amount of determination and persistence are necessary to bring about the results which I have indicated. If the teeth are pretty good, the average patient of mature years with the best intentions in the world is apt to take chances and run for luck. In the case of children excellent results can be counted on in almost every instance if we can awaken the interest of the parent. It is, of course, not in the nature of childhood to assume responsibility, nor is it desirable that such unnatural maturity should be developed as would lead children to

take thought for the morrow. Childhood has its little trials, and its sorrows are too real to be lightly ignored. If it was thought that this book would add to the troubles of children the manuscript would have been burned before it reached the printers. It is to save them pain and the mortification of having undeveloped jaws and ill-looking teeth that the importance of feeding simple, natural foods, rich in tooth and bone building materials, is so strenuously insisted upon.

It is not within the author's province more than in a general way to designate articles suited to the diet of the child. Several hints can be made, however, which may prove of value. Wheat in its natural forms and bread made of whole-wheat flour stand very high in the list of bone and tooth builders. Speaking of flours, Harrington says: "Flours are graded according to color and appearance, those which make the whitest bread ranking the highest, although not equal in nutritive value to those classed as low grade." Bread should never be eaten until it is at least twenty-four hours old, when it will have acquired a firm enough texture to be ground into pulp by the teeth. This assures its being thoroughly mixed with the saliva, and this step in the digestive process is of great importance, since the digestion of bread and other starchy materials begins in the mouth and is dependent upon the action of saliva. All starchy foods should be eaten slowly, in order that the mixing process may be com-

plete, and as fresh bread forms a sticky, glutinous mass, not easily penetrated by the saliva, it should be avoided. A small amount of saliva will convert into sugar a large amount of starch if time be allowed for the proper mixing of the two. The conversion into sugar is the first step in the digestion of starch.

Rye is an excellent food, and is usually digested readily. It is used much more commonly in Europe than is wheat because of its lower price. It is rich in gluten and makes excellent bread, and some of the forms of hard Swedish bread might be introduced in this country with great advantage to health. They are of especial value because they are rather pleasant to chew and because they furnish exercise for the teeth and masticatory muscles. Barley is a much-neglected cereal that deserves a more extended use. It is rarely seen on the American table, but it is extremely palatable if properly prepared, and it is said to be easily digested.

Oats in the form of oatmeal are probably more widely used as a breakfast cereal than any other grain, and when oatmeal can be digested readily it is an article of diet rich in nutrition, and especially valuable for those engaged in outdoor exercise. Its use in the case of very young children should be carefully watched and restricted if digestive disturbances are found to follow its use. The habit of adding to oatmeal large quantities of sugar to over-

come the slight bitterness in its taste adds to the possibility of digestive disturbances. Used properly it is a food of great nutritive value, and its moderate price brings it within the reach of all.

Rice is easily digested, but is lacking in the phosphates which go to build up teeth and bone. Cornmeal, while an excellent and nutritious article of food, has, as compared with wheat, a lower per cent of proteids and of mineral salts. Peas and beans, when mature and ripe, are rich in mineral salts, but in this condition are less palatable and are not as readily digested as when picked in their unripe and immature condition. They are, however, of less nutrient value in the unripe state. Natural fruits are much more valuable as articles of diet than a mere chemical analysis would seem to show. Harrington says: "On account of their richness in vegetable acids and their salts, which in the system are decomposed and converted to carbonates, they tend to diminish the acidity of the urine." Children often crave fruit, and it is usually easy of digestion if fresh and ripe. Nothing could be more deleterious than fruit in an unsound or unripe condition. Milk and meat have already been spoken of. Too little use is made of the former by growing children. It should not, however, be used to wash down unmasticated foods. Good butter is a wholesome addition to our diet, but is, unfortunately, too expensive to be used freely by the poor, and there is a deference to what is known as

" good form," which restricts its use among the rich. Bread and butter is a natural as it is a scientific and palatable combination; the ingredients lacking in one article are made up by those contained in the other.

CHAPTER VI

EATING SLOWLY

Of course the best of all conservators of good health is tact and good judgment on the part of the parent, together with cheerfulness and a reasonable degree of adaptability on the part of the child. The effort has been made to show that natural foods are better suited to the development of the child and more properly adapted to the needs of the adult organism than are foods artificially prepared. Triumphs of modern culinary art and foods that melt in the mouth are not usually the foods best adapted to the wants of the body, yet there ought to be no unreasonable restriction in our diet in order to keep it simple, wholesome, and well suited to our requirements. A little study will discover a great variety of suitable foods ready for our use, and a little ingenuity will provide infinite and delicious combinations to suit every meal in the year.

Provided that the diet is all that it should be, then in order to get the best results a few simple rules will be found of assistance. Insist upon the child eating slowly. A young child usually will eat slowly if left to his own devices. If he has acquired

the habit of eating rapidly, he has probably acquired it either by coming in contact with those who eat rapidly or from being urged to hurry his meal. Think for a minute of the child's first meal at the table. It matters not whether it is in the nursery or at the family table. The child is given a mouthful of food, and whatever it is he ordinarily takes time to chew it and mix it with saliva. His attention wanders from his food after every mouthful, and is usually brought back by the nurse, who presents a newly filled spoon to his mouth and urges him to hurry and swallow the food that he is deliberately chewing. It is a long and tedious operation for a nervous mother or nurse to feed a deliberate child patiently, and she is apt to hurry the operation until the child is forced out of the habit of eating slowly, when he begins to swallow his food without mastication in the effort to adapt himself to the high-pressure conditions which are imposed upon him.

A little later, at the family table (and it is regretted that the same conditions prevail at many boarding-schools), if the child still retains any degree of moderation in eating it is speedily destroyed. The breakfast hour is delayed until the very last moment, and the child has just time to swallow a hasty, ill-assorted meal with the assistance of some liquid with which to wash it down, and reach school before the nine-o'clock hour strikes. Or if it happens that the breakfast hour is early enough for the

child, it may be the father who is hurried. He is obliged to catch a train or must be at his office at a certain time, and, as he comes down to breakfast at the last moment, he is obliged to hurry his meal to accomplish his object. Nothing is more infectious than nervous haste at a meal. One person hurrying to catch a train will infect every one else with the spirit of haste and spoil the meal for every one at the table. Is it any wonder that children living in such an atmosphere of haste learn to eat rapidly and forget to chew their food? At first they try honestly enough to eat slowly, but the habit of hurrying is simply forced upon them.

Again, when children come to the family table the meal, especially the family dinner, is often made a rack upon which they are tortured. The dinner hour is deemed a peculiarly fitting time for exerting parental authority. It is suddenly discovered that the child's hands are not clean nor his hair brushed, and he is scolded and sent away from the table to repair these unfortunate omissions. This hardly serves to whet the child's appetite for his dinner nor does it insure his perfect enjoyment of the meal. It had not occurred to any one ten minutes before the dinner hour to hint pleasantly to the child that clean hands and well-ordered hair are passports to good society. Again, when he returns to the table after having performed the necessary ablutions, if there is any sin of omis-

sion or commission that he has fallen into during the day it is usually brought up, and threats of dire consequences to follow serve as a sauce for the youngster's food. He is not allowed to take part in the general conversation, and he is reproved for the slightest breach of good manners. No wonder that the child hurries his meal. No wonder that he is thin, nervous, and dyspeptic. He has been forced into this condition by the colossal asininity of his parents; and if his irritable condition brings about unnatural tastes, and if he steals away from parental authority at the earliest possible opportunity, the parents alone are to blame.

If there is one time when a truce to all strife and contention should be insisted upon it is at mealtime. The dining-room should be the pleasantest room in the house, and instead of the strained and formal function which it now is in many households the dinner hour should be the merriest, happiest hour of the day. Ample time should be allowed and all hurry should be avoided. Children especially should be unembarrassed and free to enjoy themselves. They should be encouraged to talk and joke, and the old adage of "Children should be seen and not heard" should be buried beyond any possibility of resurrection. In this way they will not only learn to love their home, but will be able to observe the chief requisite for digestion and eat slowly.

Another rule that should be rigidly enforced in the nursery is to the effect that a child should never be allowed to take a drink of anything while he has a particle of food in the mouth. This habit of washing down the food with a liquid is often one that has been acquired in the nursery, and may very possibly be the result of anxiety on the part of the nurse to finish the meal and hurry to some more congenial occupation. Dismissal should follow a violation of this rule, for its importance can not be overestimated. If the food is washed down with water or milk it can not come in contact with saliva nor can the teeth properly prepare it for stomach digestion, besides which the teeth and jaws are not afforded their proper exercise. Most children enjoy chewing, and will generally masticate their food thoroughly if they are not allowed to fall into these vicious habits. It is well to encourage children to drink all the water they require before the meal begins. The water is immediately absorbed, and if it is not too cold will not affect the gastric juices nor retard digestion. The temptation to drink a large quantity during the meal is greatly lessened if children are bountifully supplied with water between meals.

Encourage children to chew, and see that at every meal there is at least one article of food that will afford exercise for the jaws and teeth. If these simple prescriptions are begun as soon as the child is weaned, and followed conscientiously, there will

be little trouble. The child can not fail to have good teeth. As the years go on, and the gospel of natural foods and vigorous mastication is more generally preached, poor teeth will be an exception and become more and more rare.

CHAPTER VII

IRREGULARITIES

It would be out of place to mention irregularities of the teeth in a work on prevention of dental disease if it could not be demonstrated that in at least a fair proportion of cases in which irregularities occur something in the way of prevention can be done to insure the greater regularity of the teeth. Any departure from the beautiful arch which the teeth normally form must be considered an irregularity. It may be confined to a single tooth or it may extend to all the teeth. By these irregularities the expression is so altered that in many instances the lie is given to a sweet and noble character. The lines of the face are distorted, and weakness, craftiness, and degeneracy are sometimes expressed when force, honesty, and high aspirations really belong to the unfortunate owner of these misplaced teeth. The bulldog expression caused by the protruding lower jaw, and the cynical sneer due to undue prominence of the upper cuspids are familiar instances of how irregularities of the teeth may malign a beautiful character.

Not only do these irregularities affect the beauty

and symmetry of the facial contour, but they also facilitate decay. It is obvious that the teeth can not be as well cleansed when the jaw is contracted and the teeth out of line as when the arch is perfect and the teeth in their proper places; nor can mastication be perfectly performed by teeth that are out of their normal position. Two important factors in tooth preservation are thus seriously interfered with. It is hardly necessary to add that digestion is frequently hopelessly upset because of the inability of the possessor of irregular teeth to chew his food thoroughly.

In all the skulls of prehistoric races departures from the normal regular order of teeth are extremely rare. It is also true that irregularities seldom occur in the deciduous or temporary teeth of children except such as are brought about by some unfortunate habit. If it is true, then, that we almost invariably start in life with regular dental arches, and that until the second set of teeth begins to come irregularities are seldom seen, it is obvious that something must happen in the first twelve years of the child's life to account for the misplaced and irregular teeth which are so common in America. The explanation is often found in a lack of sufficient development of the jaw to accommodate the increased size of the second teeth. Almost as soon as the first dentition is completed the little temporary teeth ought to begin to separate, and small but well-defined spaces ought to appear be-

tween the teeth. These spaces should continue to increase up to the time of the appearance of the first permanent incisors. This separation of the temporary teeth tells us that the bones of the jaw are developing and are increasing in size to afford room for the permanent teeth which are soon to appear. If development is retarded and we fail to see these spaces caused by the separation of the teeth we may well be apprehensive, for it indicates that the jaws are likely to be too small to accommodate the permanent teeth when they appear. Then we may expect irregularities caused by overcrowding. In the chapter on Food, and also in the one on Lack of Exercise, attention has been called to the means by which the bones may be increased in size and the teeth strengthened. Wholesome food and vigorous use will enlarge the jaws and go far to prevent irregularities due to arrested development of the jawbone.

We have, however, other irregularities, which occur so persistently in one generation after another in certain families that we reluctantly begin to look upon them as inherited conditions. We have another most potent cause of dental irregularities in the mixing of types. A child is often seen with a full, well-rounded upper jaw, resembling perhaps his mother's, while the lower maxillary bone will be narrow and small, following the type of his father's family. Or the case may be reversed, and a large lower jaw, following the characteristics

of one side of the family, may be associated with a small upper jaw, which marks the type of the other. These unfortunate complications are believed to be more frequent in the United States than elsewhere, due largely to the mixing of the various types which go to make up the nation. Even in these distorted cases much can be done by vigorous mastication, if begun at an early age, because in the act of mastication the effort to bring the teeth into proper occlusion is unconsciously made. This serves as a corrective, while it stimulates the growth of the deficient bone. Accidents in early life may bring about irregularities. A fall or the loss of a temporary tooth, especially the loss of one of the cuspid teeth, may be followed by an irregularity, either because of the deflection of the second tooth from its proper course as it emerges from the gum or from a contraction or arrest of development in the jaw. Retention of a temporary tooth beyond the proper period may also cause an irregularity by turning aside the permanent tooth as it comes through.

So many other deformities of the mouth arise from habits contracted in infancy or early childhood that it seems fitting that the attention of mothers and nurses, as well as of physicians and dentists, should be called to such irregularities of this nature as may be entirely avoided or greatly improved by an early recognition of the conditions. Sometimes these irregularities date their origin almost from the first week of infantile life, and at such a time

simple prophylactic treatment might be begun which would effectually prevent the long chapter of painful and exhausting experiences which is a concomitant of the subsequent treatment of neglected cases. Many other cases might be modified by timely attention, and the task of correction at a later period made much simpler; and it is to these two classes of cases that the attention of those who watch over and are responsible for the proper development of the young is especially called.

It is remarkable how early in life the formation of habits begins, and it is no less remarkable how resolutely these habits, which are sometimes acquired in the first week of infantile life, are continued. Educated physicians of the present day, recognizing this fact, insist that the newborn infant shall not be rocked to sleep, nor is the nurse permitted to walk the floor with the child to stop its crying. Food is allowed to be given at stated intervals only, and is never given to allay the child's fretfulness, but solely for nourishment. From the moment of birth every hour of the twenty-four is marked out for certain purposes and every function of nature is performed at a specified time. In this way habits are quickly and easily formed which insure to the child the highest degree of health and comfort, while the mother is relieved of the worry and nervous tension entailed by a fretful child.

It is well known that in infantile life the bones are of such a cartilaginous nature that they yield

readily to very slight pressure, if that pressure is kept up for a sufficient length of time. A familiar example of this is seen in bow-legged children. The bones are bent as the result of their inability to support the weight of the body.

Certain savage tribes, as the Flat-headed Indians, alter the shape of the child's head by exerting slight but constant pressure on the yielding bones. The Tahitians, having their home in the Society Islands, not only alter the shape of the head, which they consider much improved by being flattened at the back, but devote considerable attention to the nose, and by continually squeezing and pressing it with the hand while it is tender and plastic make it conform to the fashionable shape.

The Majanja tribe, living on a tributary of the Zambesi River, adopt a curious method of disfigurement which quite alters the natural shape of the jaw. By the use of the pelele, a ring placed in the upper lip of the women, the outward curve of the jaw is gradually diminished, then flattened, and finally reversed, until the incisor teeth occupy a position behind the line of the cuspid or eye teeth. The compression of the feet of Chinese women is another instance wherein constantly applied pressure to the yielding tissue results in a deformity, and examples of the kind might be multiplied were the facts not too well known to require it. Yet, in spite of these examples, the statement will hardly be credited that a delicate infant by pressure of his

tiny hand can cause a change in the shape of the bones of his face which may result in a hideous deformity. Such, however, is the case, and it is especially noticeable in the undue prominence of the upper jaw-bone and of the upper incisor teeth, which almost invariably follows the habit of thumb-sucking. Under the general term of thumb-sucking may be included the evil habit of sucking a rubber nipple or any other object, and also the habit of thrusting almost the entire fist into the mouth.

So hideous are the deformities caused by these habits that it seems incredible that it should be necessary even to call attention to them, much less to urge that action be taken to put a stop to the evil; and were it not for the fact that many physicians as well as mothers who deplore the existence of these deformities are ignorant of the manner in which they arise, there would be no excuse for writing. Practitioners of dentistry have not always been sufficiently active in disseminating a knowledge of this subject, although they will probably be quick to recognize the good that may be accomplished by making it known that such deformities can be prevented easily.

The appearance of the child, as well as the utility of the teeth, is seriously marred as long as the condition remains untreated, yet the relief of the condition is often fraught with serious consequences to the patient by reason of the severe pain and nervous irritation produced by the regulating apparatus

which must be worn during a period of many months or years. Aside from the pain it causes, the wearing of such an apparatus is a severe trial to the sensitive nature of a child, as it draws attention in an unnatural way to the wearer, and subjects him to disagreeable comment on all sides. During the time it is worn it may seriously affect the condition of all the teeth and prepare the way for the ravages of decay. It seriously interferes with mastication, and the general health of the patient often suffers from digestive disturbances, resulting from the wearing of the regulating plate or band. Severe nervous prostration is by no means uncommon as a result of attempts to regulate the teeth; and as the work is likely to be undertaken at about the age of puberty, it becomes a serious matter, which may influence the future life of the patient. If we escape such serious consequences as have been named, the irritation of a regulating plate must result in a certain amount of interference with the child's studies. The child's pleasure will be greatly marred, while his sleep will often be rendered fretful by the ever-present nightmare of the regulating apparatus.

It must be remembered, too, that there is a large amount of uncertainty in every operation begun with the object of overcoming an oral deformity. I think it is not too much to say that four out of every five cases of regulating fail from one cause or another. It frequently happens that the patient fails to appreciate his responsibility in the treat-

ment of the case, and makes success impossible by his lack of cooperation with the dentist. He permits other matters to take precedence over his dental engagements and fails either to keep his appointments or to carry out his part of the work. It frequently happens that the attempt has to be abandoned by reason of the pain and nervous irritation caused by the apparatus. Sometimes an intervening illness or a visit made to some other part of the world interrupts the progress of the work and renders its completion much more difficult.

There are a hundred other causes which go to make these operations extremely difficult. Indeed, it sometimes seems as if there was an enemy lying in wait to attack every stage of the work, so many are the complications which arise.

The difficulties attending the moving of teeth are not, however, to be compared with the difficulties encountered in retaining them in position when once moved, and a great many failures are to be attributed to the too early removal of the retaining apparatus. After the dental arch has been molded to the proper shape and the teeth have been moved to the proper position, the greatest difficulty still remains. Unless the improved position of the teeth, which is the result of many months of labor, be maintained for a very long period by means of an apparatus, the teeth will return to their original position, or possibly to a position even less favorable than the original. It is perfectly possible to apply

mechanical pressure to a young tooth in such a way as to move it from any given spot in the mouth to another, but it may be necessary to hold that tooth in its new position for years, or submit to the disappointment of seeing it return to its former resting-place.

The responsibility incurred in attempting to straighten teeth or correct an oral irregularity is so serious that the operation should never be begun without mature deliberation and a careful weighing of all conditions which may influence the progress of the work. The family of the patient should be apprised of all the complications that may possibly arise, and the hearty cooperation of the patient and of the patient's family should be obtained before the work is begun. The patient from that moment should be under the control of the dentist so far as the disposal of his time is concerned, and the work of regulating should take precedence over all other engagements. The probable cost of the work should be frankly talked over, so that no misunderstanding can possibly arise when the work is completed.

If a child is in ill health or of feeble constitution the work should not be undertaken unless the deformity is so great that life would be made a burden by its continued existence.

Although a somewhat gloomy picture of the work of regulating teeth has been drawn, care has been taken to draw it without exaggeration. The difficulties that have been cited as belonging to

all operations undertaken for the purpose of restoring teeth to their proper positions are greatly increased when, in addition to changing the position

FIG. 3.—Showing the effects of thumb-sucking.

of certain teeth, it becomes necessary to change the shape of the dental arch as well.

This is the condition which presents itself in the

deformity arising from thumb-sucking, and every dentist who has been obliged to treat this deformity knows how serious it is. Yet treatment must be undertaken unless we are willing to have the child go through life with a repulsive face, and in after-years blame us for neglect in not insisting upon treatment. At the same time we can not fail to regret the necessity for treatment, when it is so plain that the whole disagreeable process might have been avoided by a little timely knowledge on the part of those who were responsible for the welfare of the child.

Up to this point the subject of thumb-sucking has been considered chiefly as it affects the patient's appearance. There is, however, another and a more serious side to this question, for this habit, if persisted in, may result in consequences that are far more grave than the destruction of the symmetry of the face of an otherwise handsome girl or boy. Children who are allowed to constantly suck the thumb or fingers, or any other object, quickly acquire the habit of mouth-breathing. The mouth is kept open, not only during the waking hours, but during the hours of sleep as well, for the little slave of the pernicious habit lulls himself to sleep by this soothing practise.

The muscles which close the mouth are so stretched as to lose in a measure their power of complete contraction, and after being subjected to this tension for a long period they make no effort

to bring the jaws together when the tension is removed. The jaws have been kept apart so much that the condition becomes habitual and a special muscular effort has to be made to close the mouth. The muscles of the lips lose their contractile power also and do not act without conscious effort. The nose, also, from lack of use, loses in a measure its power of action and contributes to make permanent the vicious habit already formed of breathing through the mouth. When not interfered with by accident or disease or by the vicious habit just mentioned the nose is admirably adapted to the purpose for which nature intended it. It contains certain hair-like processes, which act as a filter and prevent the entrance of dust and foreign matter, as well as the germs of disease. It has the property of being able to warm the air before it enters the bronchi on its way to the lungs, and in cold weather the temperature may be raised at least fifteen degrees in passing through the nasal passages. This alone is a great protection to the air-passages and lungs. It has also been noted that enlarged tonsils frequently accompany thumb-sucking, but it is probable that this complication is not to be attributed to the thumb-sucking primarily, but to the irritation of the throat and fauces arising from constant mouth-breathing. Children addicted to mouth-breathing are peculiarly subject to colds and throat troubles, while adenoid growths, with their long list of attendant discomforts, are stimulated if not

actually occasioned by this habit. Perhaps no one habit is responsible for so many bodily ills as that of mouth-breathing.

In many instances mouth-breathing is a habit pure and simple, and is not due to any obstruction of the nasal passages. When this fact has been established by an examination of the parts the remedy is simple. The mouth should be kept closed almost to the point of suffocation, and the nose forced to perform its function. At night the jaws should be brought together with a bandage, and another should be made to cover the mouth. After a few restless nights, if the remedy is persisted in, breathing will become natural and the bandages may be removed.

When the habit is due to an obstruction, recourse must be had to other treatment. It will astonish a person who has been unconsciously breathing through the mouth for years, and who suffers from chronic catarrh and frequent colds, to see how quickly these conditions will abate when the mouth is kept closed and the nose forced to perform its duty. "Keep your mouth shut" is excellent advice, but the habit of thumb-sucking in childhood seriously interferes with its adoption.

There is another aspect of this question of distorted features which has not received attention, but which deserves serious consideration, since it applies to any departure from the lines of symmetry of the body that may be brought about by ignorance or indulgence in early life. The moral or psychical

view of this question deserves earnest attention, for it can be effectively shown that bodily defects tend to lower the standards of morality. It has come to be recognized in our State reformatories that the first step toward the moral reformation of the criminal is to improve his physical condition and appearance. He is first taught to carry himself erect, and is made to walk with a firm step, with chest thrown out, with mouth closed, and with a bearing altogether upright and soldierly. In this way he begins to regain his self-respect, and when this has been gained his moral progress is rapid.

Children who begin life with some physical defect, be it a facial or dental deformity or a bodily ailment of any kind, are seriously handicapped in their intellectual and moral development. It would be well to remember when indulging a child in some habit which may easily result in a physical defect that his moral character may also suffer from the indulgence.

The evil which follows such habits having been pointed out, it remains only to urge with all seriousness that the habits be promptly broken, for the magnitude of the evil can not be overestimated. It may be that there are mothers in the world who are so weak and indulgent that they can not break up a harmful practise lest the dear child be caused some present discomfort. Such women are unconsciously wicked, and it is fortunate for the future of the race that they are in the minority.

When the welfare of the child is threatened, it is usually necessary only to point out the danger to have it averted. Physicians and dentists who know the serious consequences likely to arise from such childish indulgences are morally reprehensible if they remain complacently idle, and refuse to put forth the effort necessary to overcome the abuse.

Just how to correct the habit of thumb-sucking must be left largely to the judgment of those who are in daily contact with the child, and must depend somewhat upon the child's age and temperament. The hands may be strapped to the sides or tied together during the hours of sleep, and after a few nights of broken sleep the habit will be abandoned. Sometimes it is sufficient merely to give the child a stick or some simple thing that can be grasped in both hands, in doing which he quickly forgets to put his hands in his mouth, but perhaps the most effective and least annoying remedy is to tie each hand in a huge mitten, like a boxing-glove. This does not prevent the free use of the arms, while the size of the glove or mitten makes it impossible to continue the habit.

A very good plan to keep the hand away from the mouth during sleeping hours is to pin the bedclothing down so carefully as to form a sort of sleeping-bag from which the hands can not possibly escape. The vigilance of the nurse and of the family ought to be effective enough to break up the habit during the hours when the child is awake.

Sometimes the plan of smearing the fingers with some bitter drug is resorted to; but in dealing with a child it is perhaps better not to resort even to a mild deception if it can be avoided.

Whatever plan is adopted, let it be put into action without an hour's delay, and let it be persisted in until a cure is effected. No present consideration of comfort can outweigh the benefit which will accrue from wise and persistent action.

Many other minor irregularities may be overcome by exerting pressure with the thumb or finger upon the tooth or jaw, and a single tooth may often be pried into place by a stick, but all such attempts should be made by the suggestion and under the supervision of a competent dentist. Many thousands of dollars in regulating fees can be saved by an early appreciation of the conditions and by prompt interference and the use of simple methods. It is seldom wise to begin the more serious problems of regulating with plates and bands before the first teeth have come out and the second teeth have taken their places.

CHAPTER VIII

OTHER MOUTH DISTURBANCES

In the preceding chapter some of the evils of mouth-breathing were mentioned, and the habit of thumb-sucking was cited as one of the predisposing causes of this objectionable habit. Some of the diseases which are excited by mouth-breathing are bronchitis, laryngitis, and tonsillitis, and some of the disorders which it brings about are noticed in a change in the voice and hoarseness, with noisy respiration during the day and snoring at night. The secretions of the mouth may be greatly altered by the habit and the catarrhal condition which is always present in confirmed mouth-breathers is found to have a deleterious influence upon the teeth and to assist in their destruction.

From the habits and the diseases which lead to irregularities and decay of the teeth it is but a step to the consideration of some of the diseases of parts that lie adjacent and also diseases of a general character which result from dental disturbances. The most marked, as well as the most familiar, examples are those which arise from the eruption of the first teeth. The development of the deciduous teeth in

the infant is a perfectly natural physiological process, and their eruption at the proper period in a normally healthy child is often unaccompanied by any disturbances whatever. For many years teething has been made the excuse for nearly every morbid process that occurred from the fifth to the thirtieth month of the child's life. It was a cloak which covered an enormous amount of ignorance, and the lazy, slovenly physician was ever ready to give an offhand explanation of every symptom that was in the least obscure on the ground that the child was teething.

All this has been changed in the past few years, and the pendulum swinging to the other extremity of the arc finds many who are willing to assert that the eruption of the teeth gives rise to no disturbances whatever. The truth will probably be found between these two extremes, and the modern physician, alert to all the conditions of infantile life, has learned to give to each its proper value. That a causal relation does sometimes exist between the approaching eruption of a tooth and serious nervous and digestive disturbances no one can doubt who has watched such a process in an irritable child. The child carries his hand to his mouth and the mouth shows distinct signs of congestion, while the excessive flow of saliva points plainly to some great irritation. The child seems to get relief from biting hard substances and from rubbing the gums. The appetite is lost or becomes erratic, and sleepless nights

and fretful days, with digestive disturbances and diarrhœa, are not uncommon. That these symptoms all disappear when the tooth is erupted would seem to point conclusively to the fact that the incoming tooth was the cause of the disturbances.

The force which a tooth exerts in forcing its way through the gum may be compared to the force of a growing plant. This is often sufficient to break through frozen ground even, as we see illustrated every year by those brave little harbingers of spring, the crocuses.

If, by reason of crowding, or of great density of the gum tissue, or of insufficient strength of vitality, an obstacle is offered to the progress of the tooth, pressure will be felt on the pulp, and, through the dental nerves, may readily cause reflex disturbances in other organs. Dr. T. M. Rotch calls attention to the relation between difficult dentition and aural disturbances, and the author has had brought to his notice many cases wherein the eruption of a tooth was accompanied by marked eye disturbances. In two cases a marked conjunctivitis was set up which ceased immediately as soon as the tooth came through.

The remedy is often found in judicious lancing. Judicious lancing is not the superficial scratching of the surface of the gum which is so frequently and uselessly performed. Such a timid operation will only leave a scar that will offer more resistance to the erupting tooth than did the original gum tissue.

When lancing is indicated the incision should be carried well down to the crown of the incoming tooth. This operation is by no means a trivial one, to be lightly considered. It should be carefully prepared for by sterilizing the hands and the instruments to be used and by washing the patient's mouth as thoroughly as possible with some antiseptic. Aseptic conditions in the mouth are never quite possible, but we can always be sure that no source of infection is carried to the part by the hands or instruments. Wounds of the mouth almost invariably do well, and there is little to be feared as a result of lancing if the operation is properly performed, provided always that the case has received careful consideration, and the lancing has been determined upon as a result of such consideration.

Stomatitis, while not necessarily connected with caries of the teeth nor yet dependent upon the eruption of the teeth, is yet a disease deserving mention. It is an inflammation of the mucous membrane of the mouth, and is most frequently seen in early infantile life, although it may occur in one of its many forms in the adult. In the infant it is often a serious disease, giving rise to a great variety of symptoms, causing great pain and frequently preventing the child from taking food. No attempt should be made to treat these more serious cases without the advice of a physician. The milder form sometimes known as canker and characterized by a mild inflammation of the mucous membrane with

slight ulcers, when it occurs in the adult, ordinarily requires little or no treatment. A wash of bicarbonate of soda and water and slight applications to the ulcerated spot of nitrate of silver will usually be all that is needed.

Disturbances due to second dentition have received but little consideration. The reflex disturbances due to the eruption of the second teeth are not usually severe, yet they are often sufficient to cause the child to become irritable and to lose appetite. This sometimes occurs at the period of eruption of the first permanent, or six-year molars, and ordinarily calls for no special treatment. Attention to the diet of the child and a little patience and consideration for his fretful condition will be all that is necessary to tide him over this period. The second, or improperly called twelve-year molars, are more likely to set up a train of nervous symptoms than is generally appreciated. This is particularly true in cases where the jaw is short and the teeth crowded. If hysteria, fretfulness, loss of appetite, irritation of the eyes and ears, and even more serious symptoms occur about the ninth or tenth year, a careful examination should be made to discover if the second molar, painfully pushing its way toward the surface, may not give rise to these symptoms. If necessary, the X-ray should be employed to give the exact location of the tooth in the jaw and its relation to the other teeth. In most cases lancing, deep and thorough, will be all

that is needed to relieve these symptoms, but cases will sometimes be met with where the severity of the symptoms is so great that every other remedy failing it will be necessary to resort to extraction of the first molar immediately in front of the incoming tooth to relieve the pressure. This, of course, must not be resorted to without consultation with the best available authorities. Fortunately, however, when in such cases extraction is performed, relief is immediate and the second molar moves rapidly forward to fill up the space made by the extracted tooth. There is less danger of the tipping forward of the second molar when extraction of the first is performed at this early age.

The disturbances caused by the coming in of the third molars or wisdom-teeth are quite familiar. The reflex disturbances of the eye and ear, the tonsillitis and neuralgic pains associated with the eruption of these teeth are known to all. Professional advice will naturally be sought when the symptoms become sufficiently annoying and treatment will be adopted to suit the peculiar conditions of each case. A safe rule, however, to apply to erupting wisdom-teeth is never to allow the inflammation to go far enough to cause suppuration. The close proximity of vital parts and the tendency of pus to burrow makes any departure from this rule an unwarranted risk. If it be impossible to extract the wisdom-tooth it would be better to relieve the pressure by extracting the second molar rather than

run the risk of suppurative inflammation in the glands of the surrounding parts and other dangerous complications.

Closely connected with diseases of dentition are those which arise from defective teeth of either the temporary or permanent set. Inflammation of the antrum, extending to the sinuses and to the floor of the orbit, may and frequently does have its origin in a diseased tooth. Conjunctivitis, inflammation of the cornea, muscular paralysis, orbital neuralgia, amblyopia or partial loss of vision, abnormal protrusion of the eyeball, and other diseases of the eye may be caused directly or indirectly by carious teeth.

One case is recalled by the author which may be of interest. A diagnosis had been made in the case of a well-known woman of about fifty-five years of age, of progressive atrophy of the optic nerve, and the prognosis was extremely unfavorable. Blindness seemed inevitable. Naturally the sorrow in the family circle was intense, and the loving children of this excellent mother were in despair. The woman had been wearing for many years a full set of artificial teeth, which had never been entirely comfortable, but which had been worn with resignation on the supposition that it was the best that could be made. It was suggested to the son that his mother's mouth should be examined on the slight possibility that some dental disturbance might exist. After some persuasion, the patient submitted to a

careful examination of her mouth with the result that the roots of four diseased teeth were found which had been carelessly overlooked or for some unknown reason purposely left when the plate was made. These were extracted and a new plate was made which fitted accurately and was a distinct comfort to the wearer. In three months there was a marked improvement in the patient's vision. In seven months she dismissed her secretary and began to take care of her own correspondence, and at the end of about fourteen months the last trace of weakness had disappeared and her eyes had completely recovered. In the five years which have followed there has been no recurrence of the symptoms. While this case might be explained on the score of mistaken diagnosis or on the ground of mere coincidence, it is suggestive enough to warrant a careful examination of the teeth when the eyes are involved and loss of vision is threatened. The author was not long since able to relieve a case of spasmodic contraction of the muscles of the eyelids by treatment of a diseased tooth.

Diseases of the ear may be dependent upon disturbances arising from decayed teeth, and the aurist not infrequently calls in the dentist to assist in the diagnosis and treatment of these obscure cases. Diseases of the lymphatic glands of the neck are often dependent upon diseases of the teeth. Indeed, in a certain proportion of these cases there is no other cause, and in all cases a careful examination

of the teeth should precede treatment. When gastric disturbances are considered, it is found that the number proceeding from imperfect mastication caused by a neglected and diseased condition of the teeth far outnumbers those from all other causes put together. The indirect consequences of neglect of the teeth may prove fatal, and in every case are sufficiently serious to cause alarm.

CHAPTER IX

PREVENTION OF CARIES OR DECAY

We come now to the consideration of another phase of the question of how to prevent dental caries or decay of the teeth. What can a mother do for her child? What can a patient do for himself in protecting the teeth from the influences of imperfect environment? The word environment is here used to cover those conditions which exist in the mouth itself, and which may serve, on the one hand, to protect the teeth from decay, or which, being faulty, may encourage and stimulate decay. A large, well-formed arch in which well-shaped teeth are placed in regular natural order should be considered a protecting environment, because such a faultless arch would be almost self-cleansing. Natural, healthy saliva, freedom from catarrhal and gastric troubles, and an unobstructed nose which can be used for breathing purposes and which will enable the patient to keep his mouth shut—all these will go far to make up an environment that must be looked upon as exceedingly favorable to the prevention of decay.

A narrow, contracted jaw and badly shaped, ir-

regularly placed teeth with mucus-laden saliva, inflamed and enlarged tonsils, adenoid growths, and other obstructions which favor the habit of mouth-breathing, all tend to produce an environment that is unfavorable to the preservation of the teeth. Badly shaped teeth, instead of being self-cleansing, render the removal of food particles extremely difficult, while irregular teeth offer many a nook and cranny where food may rest and form a perfect hot-bed for the development of bacteria. Adenoid growths and all other influences which induce mouth-breathing tend also to disturb the secretions of the mouth and unhealthy secretions contribute to the destruction of the teeth.

We have seen that bacteria thrive and multiply much more rapidly in saliva that is thick and laden with mucus than in healthy normal saliva. This thick and ropy saliva also clings to the teeth tenaciously and covers them with a glue-like coating containing many acid-producing or tooth-destroying germs. At night, especially if the mouth is left open, and particularly if the evening brushing has been neglected, this coating becomes so hard that it resists the morning attempt at polishing, and the feeble mastication of soft foods is entirely insufficient to wear it off. We have then a transparent invisible coating, more or less complete, which contains acid-producing bacteria, and which holds these destroyers or their acid products in direct contact with the teeth.

Teeth in which the enamel is unpolished or in which deep sulci or fissures exist upon their grinding surfaces are particularly liable to decay. These depressions, which are found chiefly on the molar and bicuspid teeth, catch and hold food particles, and are exceedingly difficult to thoroughly cleanse. Smooth, highly polished enamel offers great resistance to the destructive forces.

It was probably this highly polished condition of the teeth of uncivilized people that had so much to do with their freedom from decay. It is not, perhaps, strictly true that decay is a disease of modern civilization. The author has found in examining about seven hundred skulls of different uncivilized races that there were evidences of decay in about one tooth in forty-five, but few of these teeth would have required any treatment. That is to say, in seven hundred people there was scarcely a mouth in which a dental operation would have been justifiable, and these were not selected cases. What story would seven hundred average skulls of average Americans tell to-day? It would be remarkable if one skull in the entire number did not show such evidence of decay of the teeth as would indicate a need of dental operations.

Nature entitles every individual to as fine a set of teeth as his ancestors possessed, just as every man is entitled to a living, but in both cases he is obliged to work hard to get what he is entitled to. Intelligence, high aims, and energy will do as much

in the one case as in the other, and unless there is a handicap of some unfortunate inheritance it is possible to have good teeth if the necessary exertion is made. If we could have selected our ancestors we should have had an easier problem to work out, but there is scarcely an evil tendency that can not be corrected, and there is scarcely a set of teeth that can not be made useful, comfortable, and even attractive, if the work is begun early enough and sufficient thought is given to the subject.

We are certainly unwilling to go back to the life of our uncivilized forefathers, even if by so doing we could obtain some of the physical blessings which they enjoyed and which we admire. What, then, must we do? Realizing the immense benefit which simple food and hygienic measures will bring about, mindful of the truth that mastication will polish the teeth and stimulate healthy nutrition, appreciating the fact that inherited tendencies may be overcome or their effects minimized by careful attention to the laws of health, still we know that all these things take time, and the fruition of our ambition can not be reached in a day.

In the meantime the teeth decay, and we assert that we are anxious to interfere to prevent their loss. The fact is that the vast majority of civilized people are not anxious to prevent decay. In a vague sort of a way we have certain aspirations after good teeth, but we expect some miracle to be performed for our benefit, and delay the necessary

personal effort until it is too late. The author is forced to admit that among the most refined and educated people he has met there are very, very few who are willing to give up fifteen minutes of every day to the care of their own or of their children's teeth. The fact that it can be shown that such a course would result in practical immunity from decay is not a sufficient temptation to make the required exertion. That they do from time to time make a spasmodic effort to gain this desirable end there is no doubt, but persistent, intelligent, and conscientious care of the teeth is not the rule in this busy age. That the interest in the subject is increasing must be frankly admitted, and it is almost certain that the next generation will show a better condition of the dental organs than exists to-day.

The dentist is often at fault in not explaining in detail just what care should be taken. Dentists are sometimes so discouraged by repeated failures to make an impression upon careless patients that they give up trying to instruct them. It is also true that the crowded moments of a busy practise afford too little opportunity for such instructions, unless a special appointment is made which shall be devoted to the operation of cleansing the teeth and to the instruction of the patient in this matter.

Once in a while it happens that we meet one of those God-selected mothers who insist upon having everything done that can favorably affect the welfare of her children. Such a woman carries every

one up to the very highest standard of effort, and the dentist is not only given the opportunity of caring for her children's teeth, but every non-essential is thrust aside to make it as easy as possible for him to carry out his plan of treatment, besides which his efforts are seconded by the most faithful and intelligent care at home.

The burden of responsibility then falls upon the dentist, and no matter what wretched teeth that child normally inherits, no matter what evil tendencies are at work to destroy them, the child should grow up with a strong, serviceable set of teeth, having escaped almost every painful operation, except perhaps the annoying process of regulating. If under the circumstances mentioned the child should ever have a large or serious cavity the dentist would be responsible, for with the child under his control and with the cooperation of the mother there should be no excuse, save illness, for any serious dental operation.

As a matter of fact, the dentist is usually handicapped by the indifference of people who treat the matter casually and feel that a little delay will not matter. It is the old habit of neglecting a slight cold until it becomes pneumonia, with this difference, that a cold frequently gets well without treatment, while a minute point of decay steadily and inevitably progresses until the tooth is lost. There is no escape if treatment is delayed. Few dentists wish to delay treatment, and there are few who

would not greatly prefer to prevent the trouble altogether if they were given the opportunity. The question almost resolves itself into that other one of how much time and thought we are willing to devote to the teeth.

Assuming that we have resolved that the child shall, if possible, have good teeth we begin our care as soon as the first tooth comes through. A clean, soft wet cloth may be used to wipe off the teeth, and if this does not seem sufficient to keep them bright and shining a little chalk may be used on the cloth. If the nurse is wise and feels her way carefully, so as not to arouse opposition, this cleansing may be done after every meal, and will become a delight to the child, who will experience a sense of relief and refreshment on having his teeth and gums rubbed. This will also teach the child to open the mouth, and in this way will simplify the dentist's work when the time for the first visit has arrived.

When the first temporary molars have been cut the brush may be used. It should be small and the bristles should be soft and it should be used very gently. Gradually brushes of harder bristles may be selected, but care must be used, so that the cleansing of the teeth shall always be an agreeable occupation for the child. The child will usually evince an early desire to polish his own teeth, and he should be encouraged in this and taught how to do it. It is well to remember that most brushes are

too large, and that the smallest is usually best suited to the baby's teeth. It should be borne in mind that it will do no harm to rub over the grinding surfaces of the teeth as vigorously as circumstances will permit, but that care must be used in brushing near the gum margins. The cloth or brush must be kept surgically clean, otherwise it will become a breeding-place for bacteria. After using, it should be washed in hot water and an antiseptic, and before using again the hot water should be allowed to flow over it, after which it may be put into the cold water to be used in cleansing the teeth. Moderately cold water is usually more agreeable to the child than warm water, and is altogether more stimulating and refreshing to the mucous membrane of the mouth.

At as early an age as possible the habit of brushing the tongue should be incorporated with the care of the teeth, for the tongue forms a lodging- and breeding-place for bacteria, and by keeping it clean, not only are the teeth protected, but the health of the child as well. Nothing is better than the ordinary tooth-brush for this purpose. Of course, great care must be taken not to disturb the child or make the operation of cleansing repulsive by a too early insistence on this course.

The child should never by any suggestion on the part of the nurse or parent be made aware of the fact that toothache exists in the world, nor should he ever be told except by the dentist at the proper

time that dental operations are painful. Dread of the dentist is not inherent in a child, but when it exists it has usually been taught the child by some recitation in his presence of the dental woes of the nurse or mother, or by some elder brother or sister. Until the child has come to know the dentist thoroughly it is important that he should be free from all prejudice and apprehension. After that, if the dentist is worthy of confidence, the child will trust him, and there need be no fear of trouble from any nursery tales of the horrors of dentistry.

That the temporary teeth are worth all the trouble and care that may be bestowed upon them is now so generally conceded that it is hardly necessary to argue the matter. It will do no harm, however, to reiterate a few of the reasons which make this care an imperative duty. Perfect mastication can be performed with healthy teeth only. As soon as teeth begin to decay the child avoids chewing, because the operation is a painful one when the teeth are decayed and sensitive. This involves swallowing the food without mastication, and digestion is impaired. It has been stated before that development of the jaw depends in a large measure upon the exercise which mastication affords, and if it is deprived of this exercise by failure to use the teeth an arrest of development is likely to follow. The exemption from pain is another sufficient reason for caring for these first teeth, for if allowed to decay they will produce exactly the same suffering that

later comes with the decay of the permanent teeth. Moreover, if the temporary teeth lose their vitality the roots do not become absorbed readily, and the incoming of the second teeth is thereby interrupted. The retention beyond the proper period of a temporary tooth is likely to produce an irregularity in the second teeth. Similar irregularities may also be produced by the too early extraction of a first tooth. The general health of the child and the comfort of the parent are greatly enhanced by keeping the first teeth in order, and no effort can be considered as wasted which tends to this end.

If the teeth have been cleansed as has been suggested there will ordinarily be no need of an examination by the dentist until the child is about three years old. Up to this time the teeth must be carefully watched by both nurse and mother, and if suspicious marks appear professional advice should be sought. Great tact and intelligence must be exercised about the first visits to the dentist. Occasionally one meets a child who will climb into the chair and submit to an examination or even to an operation at the first visit, but it is unwise and perhaps unfair to expect it. The dental office and all the surroundings are unfamiliar to the child and the face of the dentist is strange. The effort to persuade the child that there is nothing to be afraid of will, if the child is a reasoning being, arouse his suspicions, while the smile on the dentist's face and his

honeyed words will seem almost too good to be trusted.

The best way is to have the child go to the dentist's office with the mother a number of times when she goes to make an appointment or to have a wedge changed or to have any slight or painless operation performed. Or, if more convenient, the child can be sent in with the nurse and allowed to become familiar with the office; and these visits should be repeated a dozen times, if necessary. The nurse will read to the child or allow him to play about the dentist's reception-room until he feels perfectly at home in the place. On these occasions the dentist whose future patient the child is to be will pass through the room, speaking a word to the nurse or child, and, without making an event of the child's visit, will go back to his operating-room satisfied with having left a pleasant impression on the child's mind. The child will become accustomed to the place and acquainted with the dentist in a natural way, and it will not be long before he will manifest a desire to sit up in the big chair and have his teeth examined. With infinite tact these early visits may be made a delight to the child, who will never prove a troublesome patient.

It is not quite as convenient, perhaps, but the results are usually better when one child is sent at a time. There is sometimes a little tendency to "show off" before other children which makes the child in the chair rather less amenable to the will

of the operator, while the restlessness of the child playing about the room also affects unfavorably the one in the chair. Of course, if there is a question of discipline to be solved, it is imperative that there should be no other children about. Again, it is far better in the majority of instances that the mother should not accompany the child to the dentist, but should send the nurse or maid in her place. Of course if the child is perfectly submissive, as most children are who have been fairly treated, it will make little difference who goes with the child, but if there is any possibility that things may not move quite smoothly the child should always be sent with the nurse. The child should not be sent to a dentist who can not be relied upon to deal with him honorably, and the presence of the mother at the side of the operating-chair too often implies a lack of confidence, which the child is quick to notice and take advantage of. Then again, no matter how strict a disciplinarian the mother may be at home, she can not exert her authority at the dentist's office, and the child is quick to discover this fact and make use of it.

Fortunately, however, the cases where children behave badly in the dentist's chair are extremely rare. They are usually better patients than their elders, and the author has yet to meet with a child whose home training has been good who, if properly prepared for it, will not willingly submit to any operation, painful or otherwise, that is thought

needful. Nor has he ever met with an instance where the child felt any resentment or ill will toward the operator for such an operation if he had been treated frankly and honestly in the matter. Of course children have been met with who have passed through long periods of illness and have come to think of the word "doctor" with indescribable horror, and with such children any attempt to use an instrument produces a feeling of terror. These patients must be handled with infinite patience and consideration, and in time they will come to look upon the dentist as a trusted friend. The child who is not brought to the dentist until pain is experienced will probably prove a somewhat trying case. The censure which the parent should receive for this cruel negligence must not be bestowed upon the child when he objects to treatment. Indeed, the child is deserving of the deepest sympathy and the tenderest care.

In most cases at the first regular appointment an examination will be made if possible, and if all goes well a little polishing may be done. Assuming that all the teeth are sound, as they should be, the little patient will be asked to come again in two months. If, however, a slight mark of decay shows itself it should be filled. If the preliminary handling is judicious this will not be difficult, but it must be done slowly and carefully. Hurried movements and impatience will only tend to rebellion. It is wisest to refrain from the use of the rubber dam or of the

dental engine in these cases, for they are never pleasant, and at this age they are likely to excite the apprehension of pain.

One cavity having been found tells us plainly that there are influences at work that may produce others. Indeed, if it were possible to examine the teeth with a microscope, we should probably find that caries had already started in other teeth, and we should be warned to prepare for its advance. Our first step would be to polish every part of every tooth carefully with pumice, and this may be followed up by finer powders, such as chalk and Tripoli powder. Instructions as to the care of the teeth are now given to the parent or to the nurse, and another appointment is made for, let us say, three weeks from date. At this second appointment the teeth are again carefully polished and examined. If an improvement is seen and all is going well we may risk extending the time between visits, and give the next appointment for four or five weeks from date. If, on the other hand, we discover marks of increasing trouble, the time must be shortened and the appointment made for the next week or the next fortnight.

This repeated polishing removes, as nothing else will, those transparent coatings which have been shown to be so harmful, and in some measure it also frees the mouth from bacteria. It also probably acts as a substitute for the exercise which is needed to stimulate the activity of the blood-vessels and

serves to improve the texture of the teeth. Moreover, by frequent examinations, it is possible to detect each carious process at its earliest inception, and by this method, and with the cooperation of the parent, it will be possible to take the child through life without a really serious operation. If, however, the mother fails to see that the child keeps his appointment, if the interval of three weeks between visits drags on to three months, if when the child is sent for the note of the dentist elicits no reply, if the home cleansings are not rigidly enforced, the parent handicaps the dentist and prevents his putting forth his best efforts, and she alone is responsible if the child has troublesome teeth during his entire life.

The old habit of taking chances is exactly what we desire to overcome. While this plan is exact in its results, it is impossible of fulfilment unless the mother will enter into it with enthusiasm. Under this plan of treatment the frailest teeth improve, and this is attested by every dentist and every parent who has tried the plan over a sufficient length of time to give it a fair test. Indeed, with the cooperation of the parent and average health in the child itself, it is difficult to see how it can fail.

This plan of caring for the teeth by frequent examinations and frequent polishings might be made more effective and applicable to a greater number of children if the laws governing the practise of dentistry could be modified to admit of repu-

table dentists employing assistants who were not necessarily licensed dentists to do this polishing under their supervision. This would reduce the cost to the patient and enable the practitioner to enlarge his sphere of usefulness. The present dental laws are excellent and were enacted for the protection of the public against unscrupulous and incompetent practitioners, and it might be unwise to let down the bars even to the extent suggested; but if with the increase of prophylactic treatment such a course could be adopted by our lawmakers without correspondingly evil consequences it would prove a great help to the dentist who wished to make his plan of prevention cover as wide a field as possible, and would benefit the patient by greatly reducing the cost of these minor operations.

The plan of leaving the arrangement of appointments to the discretion of the dentist should be continued in adult life, and, as a rule, the patient will be grateful to the dentist who will take upon himself the responsibility of sending for him as the time approaches when it is wise to make an examination. The time should be very definitely fixed when the patient leaves the office and should be rigidly adhered to. If the dentist is crowded with work he should educate suitable assistants to take a part of his practise. This can easily be managed and a sliding scale of fees arranged for the different assistants, but whatever course is pursued, those patients who rely upon the dentist and heartily coop-

erate with him are entitled to consideration before that other class who neglect to follow his advice and allow long intervals to elapse without consulting him.

In the care of the teeth of children the busy dentist will in many cases discover a capable and earnest assistant in the mother or the intelligent nurse. She can be provided with pine and cedar and orange wood sticks and holders or port-polishers for holding the bits of wood used in polishing, and she can be taught to polish the child's teeth almost as well as it can be done by the dentist himself. Of course, for the first few months the child must be frequently seen by the dentist, and if the polishing has been too vigorous it must be modified, or if it has been insufficient the error can be pointed out and further instructions given. This plan will be found of inestimable value to the child when absence from home or a protracted illness makes it impossible to consult the dentist.

It is with some hesitation that this suggestion of teaching mothers to polish their children's teeth is made, for an unskilful person is capable of doing an immense amount of harm by bungling attempts to use the stick and the pumice. It is by no means an easy matter for even a skilful dentist to polish thoroughly the teeth of an active child of four or five. It requires time and experience to acquire real facility in performing this seemingly simple operation, but there are many mothers and nurses who

will learn quickly, and who can be trusted to polish the teeth with skill and judgment. The art of polishing the teeth of children, unfortunately, is not, perhaps can not be, properly taught in our dental schools, because such youthful patients are rarely sent to the school dispensary for treatment. Instruction in the operation of cleansing the teeth of older patients is singularly neglected in many of our dental schools. The pupils avoid the cleansing cases as being monotonous and exhausting, and as not having any bearing on the final examinations for the degree of doctor of dental medicine or surgery. It is probably true that of all the graduates of dental colleges throughout the land not one in ten has ever been taught to cleanse a set of teeth satisfactorily, and beyond such cleansings as can be done with the dental engine few students ever make any attempt before their graduation.

This, seemingly, is a shaky foundation upon which to build up a system of prophylaxis, and it is one reason why mothers should be taught to polish teeth if they possess the dexterity and judgment requisite for this simple operation. Under no circumstances, however, must the plan of frequent examinations of the child's teeth by the dentist be relinquished. He must at all times be the pilot, and if he is employed at all, he should have absolute sway and should be relied upon to guide the young child's life, so far as the teeth are involved, through the safest channels, secure against disaster. To

their credit be it said that young dentists in this age are becoming interested in the idea of preventive treatment, and will not be long in acquiring the knowledge of how to polish teeth skilfully and thoroughly.

CHAPTER X

BRUSHING, MOUTH-WASHES, ET CETERA

With the advent of the first permanent, or six-year, molars there comes an increase of danger and of responsibility and only a prompt realization of the new conditions will enable us to cope successfully with the greater difficulties to which the eruption of the second teeth give rise. These six-year molars are the largest of all the teeth and are superb grinders when they are carefully preserved. They are four in number, one on each side of the upper and lower jaws, and they come in behind the last temporary teeth without disturbing or displacing any of the first teeth. Their eruption may cause slight discomfort, but more frequently, indeed in the majority of instances, they come in without giving rise to a suggestion of trouble, and are frequently mistaken by the parent for temporary teeth. It is a sad commentary on the watchful care bestowed on the first teeth when four large teeth coming in between the ages of four and six are either unnoticed or, if noticed at all, are supposed to belong to the first set. This failure to recognize the six-year molars as permanent and valuable teeth

gives rise to great neglect in their care, and too often results in their loss; and yet it is probable that no teeth are more valuable in mastication, and the loss of no others is attended by more harmful results. There are no teeth the extraction of which will break up so thoroughly the articulation or perfect occlusion of the other teeth and which will so disastrously affect the power of mastication.

For these reasons the vigilance which has been pointed out as necessary for the preservation of the temporary teeth must be redoubled with the coming in of the first permanent molars, but the watchful eye of the dentist only can be depended upon to discover the first signs of decay in these somewhat remote teeth. It will be quite impossible for the parent to discover a cavity in the molar teeth until it has become so large as to endanger the entire tooth. Such a cavity is often in its early stages unattended by any visible discoloration, and the location of the teeth precludes the possibility of a satisfactory examination by the mother.

By the time these six-year molars have arrived the plan of frequently polishing the teeth which has been outlined, together with the opportunities for minute examinations which are afforded by such a plan, should have resulted in an almost perfect set of the first teeth. It is now merely necessary to include the six-year molars in this plan, and improve, if possible, upon the home cleansings, and as the child is now old enough to acquire some skill in the

use of the brush we should encourage and guide him in his efforts to use it. As has been said in speaking of brushes for the temporary teeth, most of them are too large. This is true of brushes for the mature mouth and permanent teeth. A brush rather small with bristles somewhat far apart and for ordinary use rather stiff should be procured. A wise dentist will see that the brush is chosen with reference to the requirements of each particular case. It is obvious that the same style of brush will not suit all kinds of mouths. The grinding surfaces of the teeth may be brushed just as hard as the patient wishes without doing the slightest harm. Indeed, vigorous brushing probably supplies in some degree the exercise and friction which the teeth ought to get by vigorous mastication of hard food, and circulation is probably stimulated in the smaller blood-vessels. Care, however, must be used when the gum margin is approached not to force the brush down upon it and wound it nor by imperceptible degrees to crowd it away from the necks of the teeth.

A great many cases of soft, spongy, and bleeding gums are the result of using too soft a brush and of eating soft food. The gums do not get enough use to stimulate the blood-vessels to healthy action. Congestion follows and the distended walls of the minute capillaries break on the slightest pressure. Massage and brushing combined with proper mastication will in a majority of instances cure these cases without other treatment. At first the brush

should be applied very quietly and gently. To begin with, it should be for these cases small and soft. Polishing such spongy gums with a stiff brush will only increase the irritation and cause inflammation. Rubbing the gums with the fingers or a clean cloth is often of great assistance, but should not be too severe at first. When the gums have become somewhat accustomed to this treatment it may be made more vigorous until they become thoroughly hard and firm, when the stiffest brush, if applied in the proper manner, will do no harm. No washes or applications should be employed except as prescribed by the dentist. The indiscriminate use of proprietary medicines and tooth-washes does incalculable harm and should be avoided.

All brushing should be toward the crown of the teeth—that is, for the upper teeth a downward motion and for the lower an upward motion should be used. This method will be found to clean the spaces between the teeth more effectively than the motion from side to side or backward and forward, and has the additional advantage of not pushing the gums away from the necks of the teeth. It requires more skill and patience to learn to brush quickly and thoroughly in this way, and the patient would do well to practise this method before a looking-glass. Indeed, the looking-glass should be in front of the patient, if possible, whenever the mouth ablutions are carried on. It rivets attention, and the patient is able to brush rapidly and at the same

time to see that each particular tooth receives its share of attention; and, if the work is conscientiously performed, he has the satisfaction of seeing the flattering results in the glass. The mirror should be used whenever it is possible, for it will guide the brush, and it will go far to break up that mechanical way of brushing which children especially fall into so easily. Children, and even "grown ups" are little inclined to concentrate their attention on the operation of brushing the teeth, but are more apt to brush in an abstracted kind of a way, while the mind wanders from Africa to the north pole during the operation. The looking-glass before one, helps to concentrate the mind on the work in hand and better results are produced.

In polishing the inside or lingual and palatal surfaces of the teeth it is not necessary to use quite the same caution as in brushing the outside, for, except as seen occasionally on the roots of molars, marked recession of the gums does not take place on the inside surfaces of teeth as a result of too severe brushing. On the outside severe injury may easily result from the too vigorous use of a hard brush. It will often be found that the outside or buccal surfaces of the second and third molars are extremely difficult to cleanse, and it is unwise to adhere too strictly to any one plan of cleansing them. When the muscles of the cheek are very rigid it will sometimes be found necessary to crowd the brush down or up, as the case may be, from the

grinding surfaces. The risk of injuring the gum in this region is so slight that we are justified in adopting any method that will insure cleanliness; for it is well known that food lodging on the outside of molar teeth at the gum margin often results in cavities that are excruciatingly painful when it becomes necessary to prepare them for filling. While brushing the teeth the mouth and brush should be frequently rinsed, in order that the food dislodged may not be carried to another part of the mouth, but may be immediately washed out. The tongue should be included in the cleansing operation, for, as has been pointed out, food particles and bacteria find a lodging-place on its rough surface.

As to the number of times a day which it is necessary to cleanse the teeth no definite statement can be made. It will depend upon the shape and regularity of the teeth, the condition of the secretions, the kind of food eaten, and the amount of mastication performed. It will depend somewhat upon the thoroughness with which the brushing is done and upon the frequency with which the more thorough polishings by the dentist takes place. It is, of course, self-evident that rapidly decaying teeth require more attention than those which are apparently extremely resistant to caries, and in some cases the frequency with which the teeth are brushed must in a measure be governed by the occupation of the patient. The teeth, if brushed properly, can never be brushed too often. As has

been stated, great injury may be done by unskilful brushing, and cases might be cited where the too vigorous brushing with a hard brush and a coarse powder has worn the teeth to an injurious degree, but the brush, if applied properly, may be used without fear as often as time and inclination will allow. The difficulty usually lies in persuading people to brush their teeth often enough and with sufficient care. There is a great difference between brushing the teeth and cleansing them. Intelligence and concentration will do much to make the brushings effective.

Self-respect and a desire for a better feeling in the mouth induces almost every decently brought-up person to brush the teeth the first thing in the morning. If the breakfast has not been delayed, two minutes can easily be taken after the meal for another brushing, and the business of the day can then be started with a clean mouth and wholesome breath. The after-breakfast cleansing should be made a fixed habit. It is not imposing a great hardship upon a child to insist upon his spending two minutes in this way before he starts for school. It is a little more difficult to care for the teeth mechanically in the middle of the day, by reason of our occupations, which frequently take us away from home at that time, but a minute or two can always be found either before or after dinner for another light brushing, and at bedtime the most thorough cleansing of the day should take place. The impor-

tance of the night cleansing is beginning to be generally recognized, and the reason naturally suggests itself. If food particles are left in the mouth at night there is a long period of absolute rest, during which acid fermentation can take place and carious action can be started. The more carefully the food has been removed and the more highly the teeth have been polished at bedtime the greater the security against decay.

It follows, of course, as an imperative rule that no food should be taken after the teeth have been cleansed for the night. The custom of giving a child a biscuit to eat as he goes to sleep has been productive of the greatest possible injury to the teeth. Whenever circumstances will allow it, it is desirable that the teeth should be brushed after every meal. When this plan can not be carried out without imposing too great a burden upon the patient the greatest possible care should be given to the brushing after breakfast in the morning, and above all to the night cleansing. Habit is quickly established, and the habit of cleansing the teeth at stated times can soon be acquired. Moreover, if begun early enough and tact is used in the management of the child, it will be an agreeable habit, and its omission will be attended with serious discomfort. It is difficult to conceive a more disagreeable plight for a person who is in the habit of using the tooth-brush and silk than to place him in a position where neither can be obtained.

Authorities differ as to the benefit derived from the use of floss silk. A few condemn it unsparingly, while others advocate its use under all circumstances. It is probable that when used by bungling fingers in a certain proportion of cases it does more harm than good, wounding the gums and causing inflammation and promoting recession of the gums from the teeth. On the other hand, if used carefully and in proper cases, it not only can do no harm, but forms a very important adjunct to our means of caring for the teeth. Of course, the dentist must be the one to decide as to its use, and he should instruct his patients in the method of using it properly. The toothpick is of doubtful utility. The presence of certain unnatural spaces between the teeth, caused by filling or by extraction or by decay, forces the unfortunate possessor of such spaces to use the toothpick for comfort, but it can only remove the coarser particles of food, and is probably of little value in preventing caries.

Ever since Miller gave us his excellent theory of dental caries an immense amount of time and money has been consumed in devising suitable mouth-washes the use of which, it was hoped, would prove to be the long-sought-for answer to the question of how to prevent decay. When it was announced that bacteria were at the bottom of the mischief antiseptics were heralded as the agents that could be depended upon to check their devastations, and

when the additional fact was grasped that these bacteria produced an acid which acted upon the teeth, then it was announced that the preparation must be not only antiseptic, but alkaline as well. A great deal of the thought and energy which has been put forth in the effort to devise a suitable mouth-wash has been honest, but a great many preparations have been put upon the market solely with the object of making money, and little heed has been given to the possibilities of injury to the teeth and soft tissues.

The attempts which have been made to invent a mouth-wash which would be agreeable to the taste, which could be used freely and without injury, and at the same time would destroy bacteria, or materially retard their development, have so far proved unsuccessful. The author confesses to great disappointment in his own attempts to devise a suitable mouth-wash. Whenever a combination of antiseptics that would effectively stop the growth of bacteria was made it was usually found that the mixture was so vile in its taste or odor that decayed teeth were almost to be preferred to it. Probably there are no drugs in the pharmacopœia which make such horrible mixtures as the antiseptics. It is usually found that the safe and pleasant antiseptics are not strong enough, and the strong ones have many objectionable features. Corrosive sublimate must be avoided as poisonous, formaldehyde is irritating, as is oil of cassia and also hydronaphthol in

reasonably strong solution. Pyrozone and many other effective agents need to be set aside on the score of their acidity. Strong alcoholic solutions are found to be badly borne by the mucous membrane of many mouths and must be abandoned, and many of the essential oils possess such a pronounced odor as to preclude their general use.

In the author's experiments no mouth-wash, either among those sold in the market under various names ending in *ol* and *ine* or among those prepared from the prescriptions of private individuals, succeeded in destroying all the bacteria in the mouth, and no matter how thoroughly the brushing and washing had been, if an ordinary soda-cracker or a piece of fresh bread was eaten, it was found that inside of two hours the mouth would teem with bacteria, and in four hours an acid reaction could in most cases be detected where the food had lodged. On the other hand, a careful brushing and washing of the mouth without the aid of a mouth-wash was found to rid the mouth of nearly 90 per cent of the bacteria it contained, and until food was taken bacteria were found to increase very slowly, provided the mouth secretions were normal. The author's experiments would lead him to believe that the removal of food particles is of greater value than the use of mouth-washes in securing immunity from decay. Dependence upon mouth-washes is likely to lead us astray, and it is well to remember that no mouth-wash can be of great value unless the

teeth are cleansed and the food particles removed before its use.

There are probably a number of useful preparations on the market, but there are also many harmful ones, and it is best to place the burden of responsibility upon the dentist and let him decide what preparation is best for the particular case. In the majority of instances he will decide, if he is clever, upon some very pleasant preparation that can be used freely and without injury to the teeth or mucous membrane, even if it is not a very powerful agent. In this way he will secure the cooperation of his patient, and the wash will prove an additional inducement for the patient to brush his teeth. This is especially true in the case of children. Bicarbonate of soda has a soothing effect on the mucous membrane of the mouth in nearly all inflamed and irritable conditions, and may be used freely. It has also the advantage of overcoming or in some measure neutralizing acid conditions. A normal salt solution is said to have antiseptic properties, and its use seems to improve the condition of the secretions and render the saliva less ropy and viscid. As much salt as can be put on a ten-cent piece and dissolved in a half tumbler of water is sufficiently strong for ordinary use.

A powder is useful, and should consist of finely prepared chalk, with the addition, if desired, of one of the essential oils of rose or wintergreen or peppermint, as the taste indicates. The addition of

sugar to a tooth-powder is harmful. Tooth-pastes are to be avoided. While it is probably not true that all tooth-pastes are harmful, yet it is true that most harmful preparations come in the form of pastes. Soaps must not be used constantly. In some mouths, probably from a certain amount of lime in the secretions, a free alkali is formed when soap is used which injuriously affects the soft tissues.

Referring once more to the effect of starchy food in affording a soil for the growth of acid-producing bacteria, it has been found, as suggested before, that freshly baked bread is more injurious than bread that is old. It is probable that the difference is found in the adhesiveness of fresh bread, which causes it to cling to the teeth and resist the attempt to remove it. Old bread, on the contrary, is hard, and requires an effort to masticate it. It is also more soluble, and is more readily mixed with the saliva and digested and does not form pasty masses which adhere to the teeth. Therefore, aside from the fact of its being more digestible, stale bread has the direct advantage of not encouraging the growth of bacteria to the same extent as fresh bread. Soft biscuits are open to much the same objection as fresh bread.

The effect of saliva in encouraging or retarding the growth of bacteria has been referred to, and it is probably one of the most important factors in the problem of decay. Able scientists are at the present

time working on the problem of how to render the saliva and other mouth secretions normal and healthy, and a great advance in prophylaxis may be expected as a result of their labors. In the meantime it may be stated that the saliva of people who chew their food thoroughly and who eat hard food is almost invariably healthy unless constitutional conditions affect it. It is also true that mouth-breathing and its attendant evils affect the mouth secretions most harmfully. Herein are two practical suggestions. If we can avoid the habit of mouth-breathing and can acquire the habit of thorough mastication we have gone far toward rendering the mouth secretions normal. Normal mouth secretions prevent decay.

CHAPTER XI

TOOTHACHE AND THE TEETH OF THE POOR

While the methods outlined in the preceding chapter will, if followed intelligently and steadfastly, eliminate from our list of ills nearly every form of toothache, there are still certain obscure forms which occur in seemingly sound and healthy teeth. Accident and neglect will continue to occur wherever human agency is depended upon, and many cases of pain and discomfort in the teeth will arise from these causes. Among the poor ignorance and the inability to have their teeth properly cared for will continue to add to their other sorrows the suffering caused by diseased teeth. Under average conditions toothache should be entirely unknown among the well-to-do classes. If closely watched and carefully treated no pulp or nerve, as it is erroneously called, should ever become exposed in any tooth, and with this cause anticipated and prevented few cases of toothache will arise to torment the world.

The death of the pulp in a tooth gives rise to by far the greatest number of cases of toothache. The pulp may die as a result of a fall or blow. In

rare cases it may die from a lowering of the vitality of the tooth due to extreme illness or to other constitutional causes. This is said to happen during pregnancy, but observations in a large number of cases fail to confirm the old wives' theory of "A tooth for every child," and it is probable that the explanation of dead teeth after the child is born will be found in the fact that the teeth have not received their usual care and that the visits to the dentist have been less frequent than usual. These causes will also explain in some measure the oft-repeated theory that the teeth soften during pregnancy and rapidly decay.

The usual cause of the death of a tooth-pulp will be found in its complete or approximate exposure due to the encroachment of decay. When the protecting covering of dentin becomes so thin as to transmit readily sensations of heat and cold and to allow irritating fluids to permeate through the softened dentin, the delicately organized structure of the pulp responds quickly to the irritation and congestion follows more or less rapidly. It is sometimes difficult to make an accurate diagnosis between an actual exposure of the pulp and a condition that approaches actual exposure. The symptoms merge into one another, and the idiosyncrasies of the patient make it quite impossible at times to determine just how far the trouble has gone. The pain is frequently greater before the exposure has actually taken place. The irritation causes conges-

tion with distention of the small blood-vessels, and confinement within the unyielding walls of the pulp-chamber produces great pressure and gives rise to that intense form of suffering which we know as jumping toothache.

There is no absolute remedy for these cases of pulp irritation, with or without exposure, except in such treatment as can be provided by the dentist. It may happen, however, that it is inconvenient or impossible to consult a dentist at once, and in such cases temporary relief will sometimes be found in saturating a bit of cotton with oil of cloves or oil of peppermint and placing it in the cavity of the tooth. The cavity should be first washed out as carefully as possible with warm water. The following prescription has been found useful in certain cases:

℞ Ess. menthæ ..... ℥ss.;
Chloral hydrat. }
Camphoræ, } ..... āā ℥j;
Morphin. chlorhydrat ..... grs. ii.
M.
Sig.: Introduce upon a pledget of cotton.

It is well to remember that toothache from an exposed pulp will recur again and again until the pulp is removed and the tooth properly treated by the dentist.

Another excruciatingly painful form of toothache is that which occurs after the tooth is dead. It

is always a surprise to a patient to learn that a dead tooth can give pain. Strictly speaking, the source of trouble in these cases is not in the tooth itself, but in the membrane surrounding the root and investing the root socket. The pericemental membrane becomes inflamed usually from some septic influence, and the first symptom is a feeling of discomfort and perhaps a slight soreness in the tooth. The tooth elongates and the pain increases. The pain is usually greater at night and sleep is interrupted. Swelling is noticed around the root of the tooth, and may extend over the entire face on the affected side and to the neck as well. If before this exaggerated condition is reached the tooth is drilled into, a discharge of pus through the opening so made will sometimes be seen. In these fortunate cases the relief from pain will be almost instantaneous. In other cases the abscess which has formed at the end of the root will increase in size until the pus finds its way to the surface of the gum and is discharged. The parts then gradually assume their normal size and appearance, and the tooth may remain perfectly comfortable until lowered vitality or exposure to cold or some other cause starts up another inflammation, and the same train of symptoms is repeated. It is unsafe to take any risk with a dead tooth. If neglected it may cause disease of the antrum and it is likely to affect the eye or ear. The glands of the neck may also be affected, and in children dead teeth are perhaps the most

common cause of those enlarged and diseased glands which so frequently require removal at the hands of the surgeon.

Sound and apparently healthy teeth will sometimes give rise to pain of a peculiarly distressing character, and the dentist will frequently be puzzled to make a diagnosis. In some cases the pain may be due to deposits of bony or calcareous matter in the pulp-chamber. These so-called pulp stones cause pressure upon the pulp, and the resulting pain is of a most intense character. Fortunately, toothache from this source is not common, but when it occurs it may affect one tooth after another in the same individual, and in the majority of cases can be cured only by destroying the pulp. Another rare form of toothache is caused by exostosis or enlargement of the root. The lodgment of foreign bodies between the teeth causes pressure on the gum and may be mistaken for toothache. Recession of the gums, which leads to the exposure of the sensitive necks of teeth, gives rise to an uneasiness that may be both persistent and troublesome, while the irritation caused by tartar may prove a constant source of annoyance.

Besides the pains which occur in the teeth from recognized causes there are many others which are known as sympathetic. These have their origin in a diseased condition of other teeth which may be somewhat remote from the one in which the pain is located. The intimate nervous relation of all the

teeth makes it quite possible for the pain caused by an abnormal condition in one tooth to be located in an apparently sound tooth some distance away and very possibly in the opposite jaw. Only great care in examination will be able to detect the cause of these obscure troubles.

Associated with sympathetic affections of the teeth are the neuralgic troubles. Almost everything in the nature of a facial pain that can not be easily located is attributed to neuralgia, and either morphine or some equally harmful drug is prescribed for its relief. Sometimes the patient is advised to bear the pain in the hope of its abating without treatment. Many of these cases are intermittent, and the patient, thanking Heaven for the intermissions, resigns himself to a lifetime of suffering. Neuralgia has never been very well defined, and the name is often used as a cloak to cover our carelessness or our ignorance. As a matter of observation, neuralgic disturbances of the fifth pair of nerves will be found in practically every case to have their origin in a diseased tooth or in malaria. Malaria will affect the nerves of the teeth to a marked degree and will produce neuralgic symptoms of an intensely painful kind. In all cases of facial neuralgia the mouth should be searched with the greatest care; for if the nerve tissue itself is not diseased it is almost inevitable that the trouble will be found in one of the teeth. Rare exceptions may be found to this rule, as when a sick headache

or sea-sickness causes all the teeth to ache. Rheumatism sometimes produces pain in the jaws and teeth, while disturbances of digestion, and even hysteria, sometimes affect the teeth in a painful way. In these cases, however, the cause is rarely to be mistaken, and the neuralgic symptoms quickly disappear under general treatment. In all cases of toothache, from whatever cause, the dentist should be consulted at once. Nothing can be gained by delay, and in many cases delay is almost suicidal. A tooth that might quickly respond to simple treatment, if taken in the early days of the disease, may require many and frequent appointments to effect a cure if the trouble is allowed to reach its height before treatment is begun. Extraction should never be resorted to except by the advice of a competent dentist. In a majority of instances it will not be necessary, and will, on the contrary, do incalculable harm.

Consideration of the subject of toothache and the extraction of teeth draws attention in a forcible way to the teeth of the poor.

As far as the teeth of the well-to-do classes is concerned, the idea of preventive treatment is beginning to be understood, and our anxiety is chiefly to extend the field of such knowledge and encourage a wider interest in prophylaxis; but the question of what we can do to improve the teeth of the poor calls for most thoughtful and prayerful consideration. Poor teeth cause poor digestion. Poor diges-

tion or irritability of the stomach causes a craving for stimulants, and stimulants cause crime. Ergo, unhealthy teeth lead to unhealthy morals.

In the economy of human life the teeth are of no less value than eyes, ears, throat, lungs, spine, or any other portion of the human anatomy, but while for diseases of every other part of the body hospitals and dispensaries offer to the poor every facility for treatment there is not throughout the length and breadth of this land a single place where a person unable to pay a fee can have the torture of an aching tooth assuaged by competent hands. The excellent work done by the dispensaries of our dental schools is, of course, not forgotten. But the work done by these institutions is solely for the purpose of instruction, and is almost infinitesimal when measured by the wide-spread need of such work. Even in these institutions a moderate charge is usually made.

It has been shown that the condition of the teeth of children in England is much better than in America, for it is recorded that an examination of 3,800 children of both sexes between the ages of three and sixteen discovered the fact that 828 had seemingly sound teeth—that is, teeth that required neither filling nor extraction. These children belonged to the poorer classes and attended the industrial schools near London. It is stated, however, that of 458 girls from parochial schools of London who entered domestic service in one year,

five-sixths had never known the use of a tooth-brush. It is probable that our poorer classes in America are not more familiar with the use of the tooth-brush than are the poor in England. Indeed, while we pride ourselves on having the most skilful dentists, there has been less recognition of the evil effects of bad teeth upon our poorer classes and less effort to correct the sad condition in this country than in England or upon the continent of Europe.

The condition pointed out as existing in England is bad enough—75 per cent of the children examined had diseased teeth—but, while in this country the examinations have been by no means systematic or complete, such evidence as we have gathered leads us to believe that 95 per cent of the children of the poorer classes have carious teeth. Some years ago a distinguished aural surgeon in New York city had an examination made of a number of school-children and discovered that scarcely any were free from dental irritation. He says: "The deplorable neglect of the teeth of these children was a surprise to me, although from previous observations I had expected to find them very bad indeed. It was a notable fact that teachers having charge of these pupils never suspected that the teeth ever gave rise to any serious trouble. On questioning the children themselves it was ascertained that in nearly every instance they had experienced more or less pain in the teeth or ears, fre-

quently in both. The appearance of many of these children suggested that the general health had not escaped the consequences of imperfectly masticated food, and that some of them also suffered from neuralgia about the head and face goes without saying." In our hospitals it is shown that the diseases of the digestive organs which come from decayed teeth far outnumber those from all other causes put together.

It would be possible to fill an entire volume in pointing out the great need of interference to preserve the teeth of the poor. Physical degeneracy must not be regarded as essential to race development. On the contrary, strong teeth are essential to the production of the best types of manhood, and degeneracy of the teeth will result in a corresponding degeneracy of the race, physically, mentally, and morally. We are in great need of dental dispensaries, and along with the establishment of these would naturally go the examination of the teeth of the children in our public schools. Good teeth, like vaccination or freedom from contagion, could then be made a prerequisite for admission. This can not be done, of course, until some provision is made to enable these children to have their teeth cared for, but when it can be accomplished it will result in greater freedom from general diseases, in higher scholarship, and in better morals. The boys will become better citizens and the girls better mothers, and the state will be re-

paid a hundredfold for the money spent in caring for its children's teeth.

The exaggerated dread of dental operations which the poor have derived from brutal extractions would soon pass away if the dispensaries were in the hands of wise and kindly men. In these dispensaries there would be afforded an opportunity to educate the masses in the care of their teeth that would result in an appreciable improvement in the health of the community. Talks to the school-children could supplement the work of education done at the dispensary. Mr. G. E. Johnson, superintendent of public schools at Andover, Mass., in an excellent article in the International Dental Journal, shows that children who have sound, well-cared-for teeth are actually heavier in weight than children of the same age with diseased teeth, and that they are at least one-half year in advance mentally of their less fortunate schoolmates. A further study of the diseases dependent upon lesions of the teeth will provide convincing proof of the need of dental dispensaries for the treatment of the teeth of the poor and will show the advantages of having the teeth of school-children examined and cared for.

CHAPTER XII

ANATOMY

About the sixth week of fetal life the work of forming the teeth is begun. The development of these organs from the original dentinal papillæ, through varying changes, to the fully formed teeth is an exceedingly interesting example of nature's perfect work, and may well excite the wonder and admiration of histologists. While it would be out of place in a work intended largely for the use of mothers to consider the development of the teeth histologically, yet it is important that any one responsible for the condition of the teeth of a child should know something of their structure, and any layman can understand and admire the beautiful precision of nature in adapting one set of teeth to the size of the child's jaw and to the simple needs of childhood and another set larger, stronger, and more firmly rooted to meet the requirements of maturer life.

In a sketch of a tooth shown in Fig. 4 it will be seen that the exposed portion of the tooth is known as the crown, the narrow constriction at the margin of the gum is called the neck, while the

portion hidden in the gum and bony tissue is known as the root or fang. The number of roots to each tooth is generally as follows: One each for the incisors, cuspids, and bicuspids, two for each of the lower molars, and three for the upper molars. Sometimes the roots show a tendency to divide and form a greater number. This is especially true of the first bicuspids and third molars. Sometimes the roots show a tendency to coalesce and form a single root in place of the two or three roots which are usual, but the arrangement suggested above may be looked upon as normal.

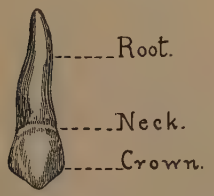

FIG. 4.—Sketch of a tooth.

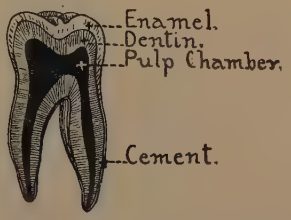

FIG. 5.—Section of a tooth.

If a vertical section of a tooth is made, as in Fig. 5, a hollow cavity will be seen at the lower part of the crown, and from it leads a canal or canals which traverse the entire length of each root. At the end of each root is a small opening through which blood-vessels pass to supply the tooth with nutrition. Through this same opening passes also a nerve. These all center in the cavity in the crown, and this extremely sensitive mass of blood-

vessels and nerve tissue is known as the pulp. What is popularly but erroneously known as the operation of killing the nerve means the destruction of the entire pulp.

The solid portion of the tooth is made up of dentin, which is sometimes spoken of as tooth bone or ivory. This is exceedingly sensitive to the cutting instrument and is usually more sensitive at the neck of the tooth and just under the enamel layer than in deeper portions. This is explained on the ground that the microscopic tubules which run through this solid portion of the tooth and which carry the plasma of the blood for the nourishment of the tooth enlarge as they terminate just under the layer of enamel and at the neck. The dentin is made up of seventy-two parts of mineral matter, principally phosphates of lime, while twenty-eight parts is animal tissue.

The enamel is the hardest substance in the body. It begins in a very thin layer at the neck of the tooth and gradually becomes thicker until on the grinding surface, which is the part subjected to the greatest amount of friction, it often measures considerably over one thirty-second of an inch in thickness. The enamel consists of ninety-six and one-half parts of earthy matter and three and one-half parts of animal matter. The cement is a thin layer covering the root of the tooth, and is more like true bone than any other portion of the tooth.

In considering the make-up of a tooth the differ-

ences which exist in the structure of the first and second set of teeth may here be disregarded. They are important to the dentist and to the histologist, but are not essential to that practical knowledge of the teeth which it is aimed to inculcate in each mother and intelligent nurse. In the diagram, Fig.

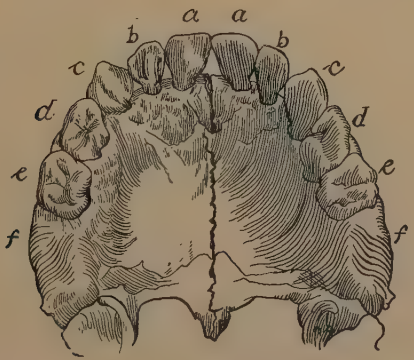

FIG. 6.—Set of temporary teeth.

6, is shown an upper set of temporary teeth, and behind the last temporary teeth the place is indicated which the six-year molars are expected to fill. It must be remembered that the lower set is in all respects the same, except that the lower teeth, especially the incisors, are smaller in size. There are also slight differences in the cusps or prominences on the molars, but these may be ignored.

The first set consists of twenty teeth only. They are called temporary, deciduous, or milk teeth. In

each jaw there are ten teeth, and their names, together with the order of their coming in, are as follows (see Fig. 6):

a a.	Two central incisors.....	5th to	8th month.
b b.	" lateral "	7th "	10th "
d d.	" first molars.....	12th "	16th "
c c.	" cuspids.....	14th "	20th "
e e.	" second molars.....	20th "	32d "

It is not a bad plan for nurses and mothers to commit the above to memory, but it is especially important to remember that the set is usually complete at the end of the third year, and that there are never more than twenty teeth in this set.

When the child is about five and one-half years old, if the mouth is examined and the teeth counted, there will probably be discovered a greater number, possibly twenty-four. It is well to remember at such a time that the first permanent molars, sometimes called the six-year molars, come in behind the last temporary molars, and do not push out a temporary tooth to make way for their eruption. *f f* in Fig. 6 shows where the first permanent molars come. Failure to recognize these teeth as belonging to the permanent set is constantly leading to neglect, and these magnificent grinders are frequently lost, owing to their being mistaken for first teeth.

The permanent teeth number thirty-two. Sixteen in the upper, and the same number in the lower jaw. This, of course, includes the third molars or wisdom-teeth, four in number, one in each posterior

corner of the mouth. Fig. 7 shows an upper jaw with all the permanent teeth in place. The order

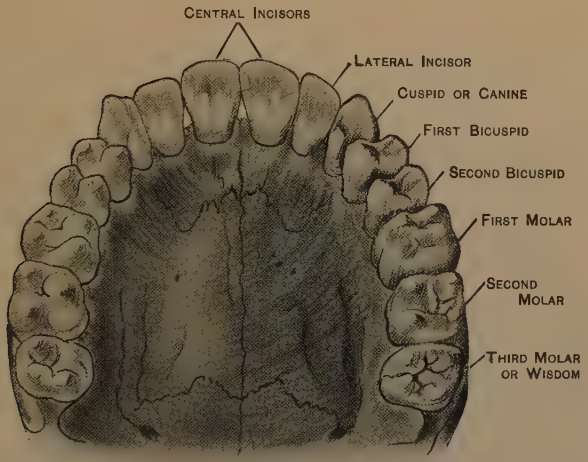

FIG. 7.—Upper jaw, showing all permanent teeth in place.

of eruption is as follows, but is subject to wide variations:

First molars	about the	6th	year.
Central incisors	" "	7th	"
Lateral "	" "	8th	"
First bicuspids	" "	9th	"
Second bicuspids	" "	10th	"
Cuspid or canine	" "	11th	"
Second molars	" "	12th	"
Third molars or wisdom-teeth	" "	17th to 25th	year.

The lower incisors usually come a few months before the upper ones, but for the sake of making it more easy to remember the upper and lower teeth

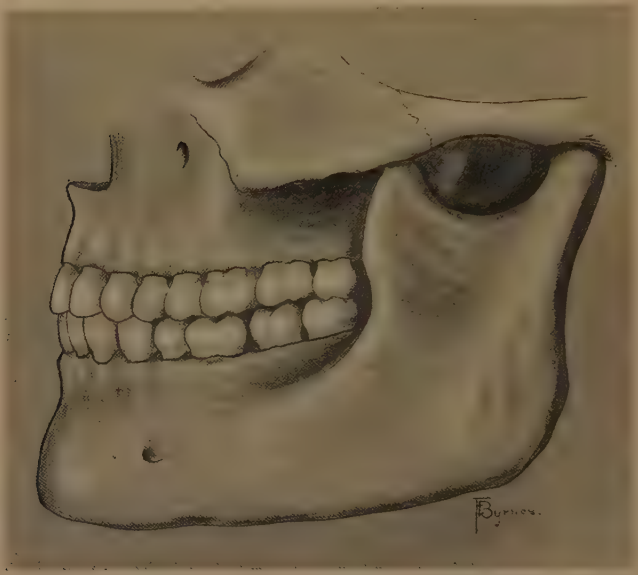

FIG. 8.—Normal occlusion of the teeth.

they have been set down as arriving at about the same time.

The lower incisors are smaller than the upper, and this makes the lower dental arch somewhat smaller than the upper, so that the front teeth do not meet edge to edge. By looking at Fig. 8 it will

be seen that the upper teeth project beyond the lower, and it will be noticed that in the normal occlusion, or coming together, of the teeth the prominent points or cusps of one set do not strike the prominent points of the other set, but fit into depressions made for their reception. It will also be seen that the teeth are so arranged that nearly every tooth comes in contact, not with one, but with two teeth of the opposite jaw. This is the most perfect arrangement possible, and confirms the statement already made that human teeth are capable of, indeed were designed for, most vigorous and powerful action. The various shapes of the teeth appear to indicate that man was expected to live on a mixed diet and teeth were given him that would enable him to prepare any kind of food for digestion.

The incisors, as their name indicates, are intended for cutting food, and have a wide cutting blade firmly supported. They are shaped not unlike a spade, and are admirably adapted for cutting or biting the food. There are four in each jaw. Once in a while an extra one will appear, usually so imperfect in shape as to necessitate its removal. Occasionally the upper lateral incisors will be missing. It is difficult to say in what proportion of cases this occurs, but next to the wisdom-teeth the lateral incisors are the most erratic.

The cuspid or canine teeth are intended for seizing and tearing. In some animals they grow to the size of enormous tusks, and these are zoological-

ly considered the largest teeth in the head. In man they are much reduced in size, yet are still powerful teeth and have much to do in giving expression to the face. The impression of strength or force of character is due in a great measure to these teeth, and no other teeth do so much in preserving the contour of the face and the natural lines of expression as the canine teeth. Their loss is attended by a complete alteration of expression, which is seldom restored by artificial substitutes. The cuspid tooth has a larger root than any other tooth, and is very firmly implanted in the jaw. It is cone-shaped, and is said to be the earliest form of tooth found in the lower vertebrates which have conical teeth.

The bicuspid teeth in man have somewhat the appearance of two cuspid or canine teeth joined together and are analogous to the premolar teeth of the lower animals. The other teeth which we have just described push out as they come in a corresponding first tooth. The incisors push out incisors. The cuspids push out cuspids, but as there are no temporary bicuspids, the bicuspids push out and take the place of the temporary molars. The first bicuspid pushes out the first and the second bicuspid pushes out the second temporary molar. These bicuspid teeth serve the purpose of crushing the food, thus preparing it for the molars which are the important grinders.

The molars are too often neglected because they are back teeth and do not show, but their work is

more important than that of any other teeth in the mouth, and their loss is usually followed by severe derangement of the stomach, due to the impossibility of satisfactorily grinding the food. There are twelve molars in all, six in each jaw, and they present broad masticating surfaces exactly adapted for grinding food and for preparing it for stomach digestion. The occlusal surfaces are uneven, which vastly improves their grinding power, but this unevenness has one disadvantage, since it furnishes a lodging-place for food particles. In the deep fissures or cracks which are sometimes seen on the grinding surfaces of these teeth, unless mastication is vigorous or the surfaces well polished, decay is prone to start, but it can always be checked in its early stages if careful examinations are made at frequent intervals. Small fillings on the grinding surfaces of these teeth do not destroy their usefulness as grinders, and such fillings, if properly made, will usually last a lifetime. If mastication were sufficiently vigorous the surfaces would be so well polished that decay would rarely be seen.

The teeth are all embedded in the upper and lower jaw-bones. The lower jaw, called also the inferior maxilla or mandible, is the largest and most powerful bone of the face. The curved horizontal part is called the body and the upright portions are called the rami. That portion of the bone into which the teeth are set is called the alveolar process or processes. It is somewhat fragile, and

pieces are frequently cracked off when a tooth is extracted. Ignorant people are frequently heard to speak of the jaw-bone being fractured in extracting a tooth, when nothing more serious has happened than the breaking off of a bit of the alveolar process. When the teeth are lost the alveolar process becomes absorbed and disappears. It sometimes is absorbed by diseased conditions, and this causes a loosening of the teeth.

There are two upper jaw-bones, which are joined together at the middle or median line. They are called the superior maxillæ, and have alveolar processes corresponding to those of the lower jaw. The superior maxillæ are fixed bones, and, unlike the lower jaw, have no power of motion. The gum tissue surrounds the teeth at their necks and covers the alveolar processes. It is tough and will withstand any amount of friction if it is in a healthy condition. It is not very sensitive unless inflamed. The tongue is a muscular body, rather complex in its formation, as it is in its function. The mucous membrane which covers the floor and roof of the mouth and the inside of the lips and cheek has numerous glands which pour out secretions which in their normal state assist in digestion. When inflamed by a cold or by more serious disease the secretions of the mucous membrane sometimes become greatly altered, and when in a diseased condition assist in the destruction of the teeth.

The principal mouth secretion is the saliva, which

comes from the salivary glands. The parotid glands are the largest and are situated in front of and below the external ear. Their ducts open on the inside of the cheek opposite the second molar teeth of the upper jaw. These are the glands which are chiefly affected in mumps. Submaxillary glands, as their name indicates, are situated on either side below the lower jaw and they open near the middle line under the tongue. They are absent in some animals, especially those that live on tasteless food, such as whole grains. It is believed that the secretion from these glands is enormously stimulated by certain kinds of foods; such food as has a pronounced flavor appears to have a marked effect in stimulating their action. The sublingual glands are placed under the tongue, and have from a dozen to twenty openings through which they pour out saliva.

This watery fluid called saliva plays many important parts. It is needed in the action of speaking to keep the mouth moist. If healthy it washes out the mouth and keeps it clean. It has an effect in keeping the Eustachian tubes in a healthy condition, and in this way assists materially in maintaining perfect hearing. It dissolves various food substances, it moistens the food, and assists in the digestion of food, especially in the digestion of starchy foods. When the flow of saliva is interfered with the mouth becomes dry, parched, and unhealthy. Taste is then either wholly or partly lost. Perfect mastication and insalivation is impossible without

the action of saliva, and when it is insufficient the food must be washed down with some liquid, which often leads to digestive disturbances of a most serious nature.

References to the anatomy of the teeth and mouth have purposely been made as brief as possible. It is not a subject that can awaken very keen interest, and only such an outline has been given as would enable one to gain an intelligent idea of these parts and of their relation to each other.

THE END

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